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With an Account of some early Models
Panoramic Photography with Special
Cameras: the Cirkut; the Panoram
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Photographs of High Buildings . How
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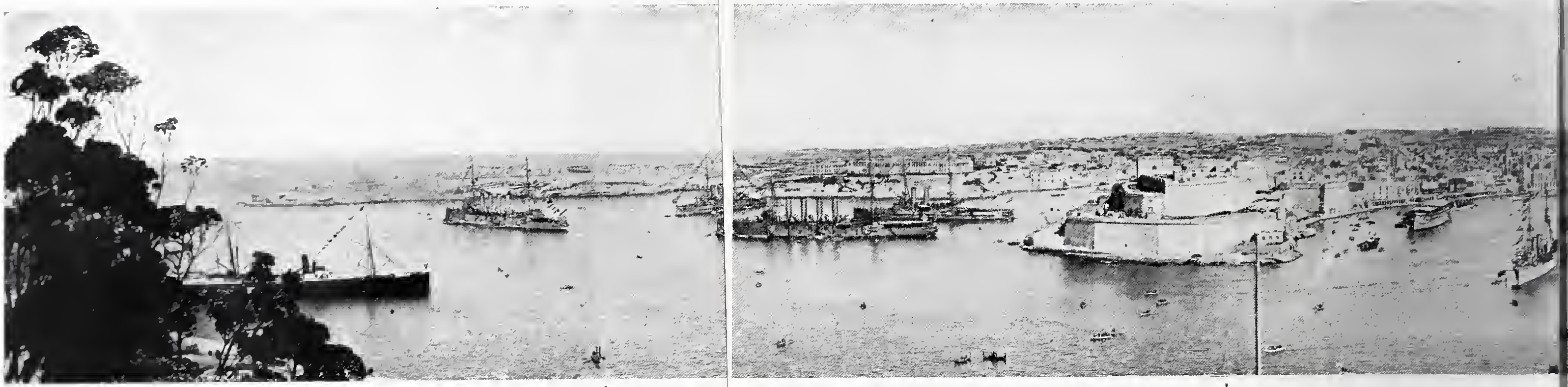
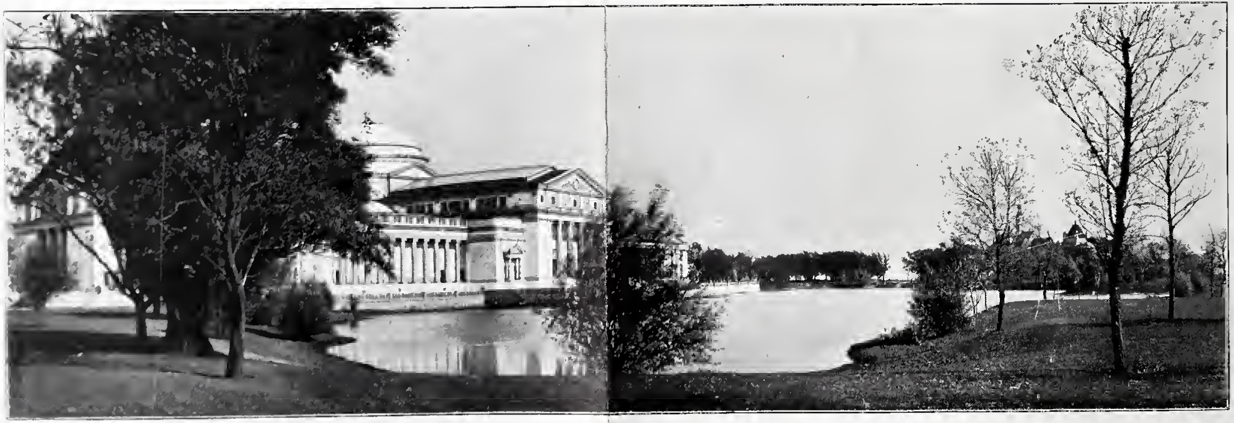


PANORAMIC VIEW OF THE HARBOR

This view was made on five plates, each 10 x 12 inches, each plate covering a section of the view. Prints from these five negatives were then prope
overlap one-half inch at each joint as marked. This separate joining



A PANORAMIC VIEW IN JACKSON PARK, CHICAGO. BY GEORGE E. MELLEN

Made on three plates 4 x 5 inches, combined in a single print, without joining, by the use of Mellen's Printing Frame.
See sections 1, 2 and 3 at right

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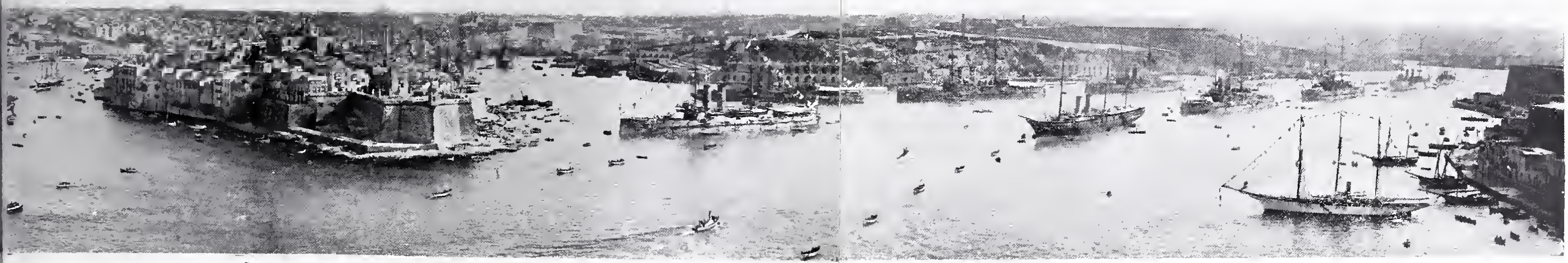
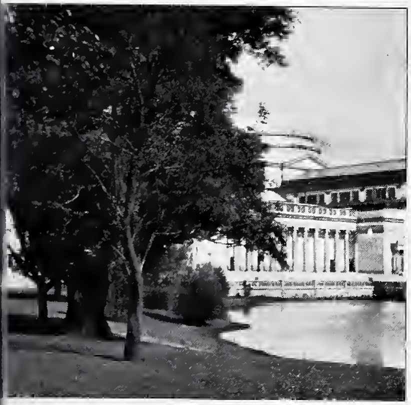
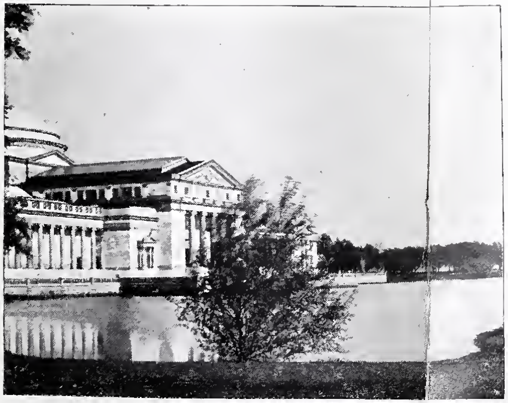


VALETTA, MALTA. BY S. L. CASSAR

trimmed to secure a true joining at each section (where marked at the base of the view, the completed print measuring 6½ x 52 inches. The sections ld have been avoided by printing the whole view on one strip of paper



SECTION 1



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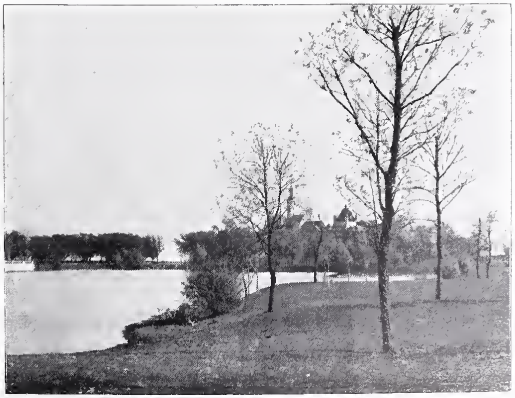

SECTION 3

from the three negatives combined in the view at the left. Note that each print includes rather more of the subject than is seen in the sections of the combined view. This is necessary to allow of correct joining in printing. See the article by George E. Mellen in this issue

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The Photo-Miniature
A Magazine of Photographic Information
EDITED BY JOHN A. TENNANT

Volume VII OCTOBER, 1905 Number 73

Panoramic Photography

Consider for a moment the infinite variety of form and proportion in all the things we photograph. The brook, low-fringed with willows, winding now through meadows and now skirting a clump of woodland; the group of farm buildings with the orchard stretching behind; the far-reaching panoramas where clouds and hilltops spread their magic transformations of light and form and color; the long-drawn and ever-changing skylines of our cities; their cañon-like streets lined with tall buildings, whose domes and cornices are silhouetted against the blue; their broad waterways and bridges; the navy yard with its battleships and smaller craft; the ball game at the athletic field and its thousands of spectators; the country circus on parade; the boat race and regatta on the river; the snow-clad Sierras, sunlit, with little towns clustering among the shadows at their base; the western cañons and cattle ranges; the summer resort by the sea; the stock-yards and factory plants covering broad acres; the railroad trestle spanning the ravine or crossing the salt marshes; the formal garden; the Exposition buildings; the convention group, and what not.

These, gentle reader, we are accustomed to crowd, squeeze, compress and condense within the narrow limits of our 3¼ x 4¼, 4 x 5 or 5 x 7 plates or films—without any thought of our unreasonableness, simply because we are ruled by convention, and do not know or appreciate the uses and advantages of panoramic photography.

Would it not be wiser and more interesting to make our photographs approximate the proportions of our subjects? To be satisfied, if we will, to get the bandwagon on a 5 x 7 plate, but to insist on a 5 x 18 when we photograph the circus parade in all the fullness of its noonday glory? I think so: hence this number of THE PHOTO-MINIATURE, wherein practical workers will tell us all about panoramic photography and how to do it.

As we shall see, there are no difficulties peculiar to panoramic work which cannot be overcome with ordinary patience and ingenuity. In fact, panoramic photography is in no wise different from the photography we know, except in the all-important result. There it is often more satisfying and more complete in its reproduction of the subject. All that we need is to know how to do it; how to begin and what points to watch as we go along. Whether we use a panoramic camera and get the subject on a single strip of film, or get it in one print by combining several sections of the view from as many separate negatives made with a hand- or stand-camera, it is as simple as it is practical and interesting. Success is chiefly a matter of familiarity with the manipulative tactics of the particular method chosen. In the use of special panoramic cameras the worker must thoroughly know his apparatus and the control of its limitations and capacities. When the ordinary view-camera is employed, success depends chiefly upon the careful following of a system of making before exposure and vignetting during printing, as will hereinafter be described. These latter methods were formerly held by those who devised them for their own advantage. Now they are published and made available for all.

Evolution

Panoramic photography is not new, either in theory or practice. As far back as 1845, Martins, a Frenchman, devised a panoramic camera in which the lens rotated, projecting the image upon a stationary curved Daguerreotype plate as it traveled across the field of view. In 1849. Talbot and Malone described a certain sensitized paper as useful for "photographic pictures giving panoramic views produced by a movement of the object glass (lens) of the camera over a curved plate." In 1857, Garella patented an apparatus "giving pictures subtending any angle of view up to 360° on a plane surface," and in his instrument we have the essential principle of most panoramic cameras which have been introduced since. This principle involves the rotation of the camera on a vertical axis, passing through the optical center of the lens, a condition which produces a stationary image of every object. The sensitive material is simultaneously moved across the axis of the lens in a contrary direction, so that the vertical strip, cut by the axis of the lens, may be regarded as stationary in space. Chevallier, in 1858, photographed the whole horizon with a camera including a curved plate which revolved, while the camera itself revolved in the opposite direction on an axis under the plate. This camera had radial shutters, limiting the surface of the plate exposed at any one time. Johnson and Harrison, in 1862, patented a camera carrying a stationary, curved plate, the camera rotating on an axis under the lens during the exposure. Silvy, in 1867, produced a circular-backed camera within which he gradually unwound the sensitive sheet from a roller or spool, just as a tape measure is withdrawn from its case. In the sixties, Braun made a series of 400 Alpine panoramas on wet collodion plates. He used a camera in which the carrier containing the long, flat plate was driven across the exposure-slit by clockwork. The series was praised for its "fine technical qualities, cloud and aërial effects."

Moessard's Cylindrograph

In 1884, P. Moessard introduced what seems to have been the first really practical panoramic camera using films—the cylindrograph. This was a folding camera. Briefly described, it consisted of two semicircular tables of wood, one of which formed the top and the other the bottom of the apparatus. The doublet lens, fixed focus, was attached to a pivot which turned on the flat side of the camera, this flat side being a flexible front of light-proof material. The film was contained in a curved celluloid holder, the curve corresponding to the back of the camera, having a radius equal to the focal length of the lens used. When the holder was placed in position and the lens brought to one end of its semi-circular transit, the cap was removed and the lens made to move through its orbit, thus producing a photograph embracing half the horizon. A model of this camera was supplied to the Canadian Pacific Railroad in 1892, and produced very successful results on films 48 x 15 inches.

Cannon's Camera

In 1887, J. R. Cannon, a Canadian, patented an extremely simple cycloramic camera fitted with a lens of fixed focus. In this instrument the film traveled between two rollers while the camera was turned by hand on the optical center of the lens. The angle of view included by this method was 360 degrees.

Damoizean's Cyclograph

A few years later (1890) M. Damoizean brought forward his cyclograph, which gave a photograph embracing the whole horizon. This camera revolved on a circular metal table, while the film unrolled itself in a contrary direction in front of a narrow vertical slit. Other good points of this camera were an automatic device for uncovering and covering the lens as the rotation of the camera began and ended, an indicator showing the amount of film remaining on the stock-roller, and an arrangement for perforating the film after each exposure, so that the sections exposed could be separated and handled individually in development.

Marcellus' Cycloramic

The cycloramic camera devised by P. Marcellus, of Philadelphia, in 1891–2, also deserves mention. This camera gave the complete circle of view, 360 degrees, with an average exposure of five seconds, and was fitted with a daylight loading device, so that several views could be made in quick succession. In the Marcellus camera, instead of bending the film in a semi-circle before the exposure was made, the film was unrolled in the line of the circle made by the camera at the focal point of the lens. This was accomplished by the simultaneous movement of camera and film. A detailed description of the instrument and an example of its work may be found at page 225 of *Wilson's Photographic Magazine* for 1894.

A TWO-PLATE 4x5 PANORAMA MADE WITH A FIVE-DOLLAR CAMERA
See article by George E. Mellen

The Star Camera

Very similar to the Moessart instrument is the Star Panoramic camera, made in New York at the present time, having a crescent-shaped back carrying a curved film, a bellows body and lens moving on a pivot over the optical center.

Stewart's Panoram

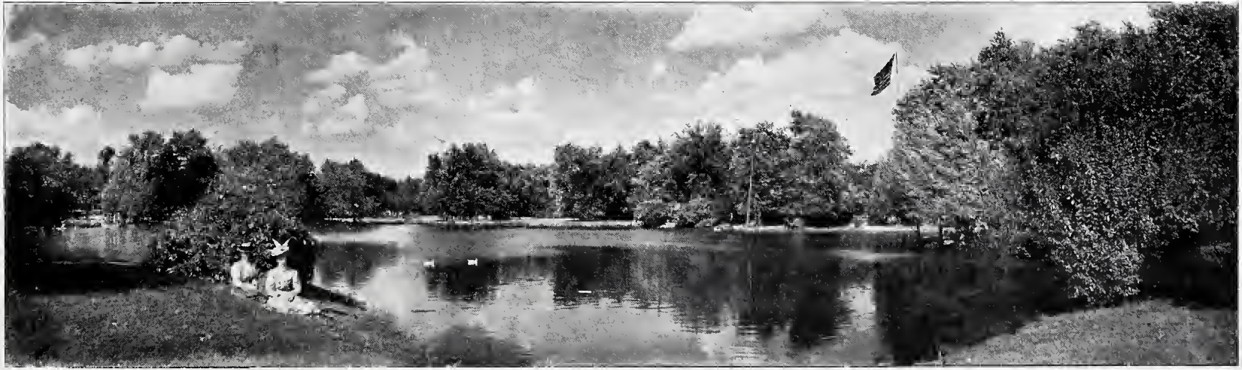
In 1893, Col. W. R. Stewart described, before the Royal Photographic Society, an ingenious camera called the Panoram, invented by Mr. Tweedy and himself. This instrument was remarkably light and portable, the model for films 3¼ inches wide weighing only four pounds, tripod included. We quote the inventor's description of its make-up and method of use:

In the Panoram a spool of Eastman film is fixed on a roller in the back of the camera, so as to unwind with a slight pull. The free end is passed across a vertical slit, through which the image formed by the lens reaches it, and is secured to a roller rotated by clockwork, so that when the clockwork is set going, the film is wound up steadily on the roller. Before passing across the slit, however, the film makes a quarter-turn round a guide-roller, and the motion of the film causes this roller to turn. The axle of this roller is prolonged through the bottom of the camera, and carries a small pulley which, by means of an intermediate wheel acting on the periphery of the circular top of the stand, causes the camera to turn round at the proper rate to receive the image. The camera consists of a rectangular box, a little longer than the equivalent focal length of the lens, and a little deeper than the width of the film used, and having a bottom width of about five inches—this latter dimension is a fixed quantity, no matter what the focal length of the lens may be. This box is screwed to a socket in the center of the circular top of the camera-stand, and through a hollow spindle communication is effected between a pneumatic release inside the camera and an elastic ball hanging by a flexible tube from the lower end of the spindle. The clockwork occupies a space in the front of the camera just under the lens, and behind the clockwork a partition with a narrow door in the center crosses the space from side to side. Behind the door two wings extend to the back of the camera, stopping just short of the focal plane of the lens, and between these wings is a cylindrical expansion, in which turns a slotted cylinder which can be rotated by a knob from the outside. From the above, it is apparent that the only light which can reach the film must pass through the door, and then through the slot in the cylinder, and, by turning the cylinder partly round, the beam of light can be narrowed or even totally eclipsed, or the shape of the opening can be altered, so as to give greater exposure to the foreground than to the sky, if required. The *modus operandi* is as follows: The camera is taken into the dark-room, the spool of film inserted, and the loose end attached to the winder. The camera is closed and locked. When required for use, it is set up on its tripod, carefully leveled, and the lens directed to the left-hand extremity of the required view. The clockwork is wound up, the slit opening adjusted, the pneumatic bulb is squeezed, when the camera will revolve on its axis. When the right-hand extremity of the view is reached, the pressure is released. The camera stops, the door is closed, and the needle punctures the film. A counter on the top of the camera records the exact amount of film used at each exposure. When all the film is used up (it is supplied in lengths varying from 240 inches to 500 inches), or sooner, if necessary, the camera is taken into the dark-room, the film divided up, developed, and fixed.

We have not been able to discover whether the Panoram is commercially available, but it was hailed, at its introduction, as completely solving the question of panoramic photography for the tourist.

The Panoram Kodak

For the amateur who wants to make panoramic photographs on a single strip of film, the only hand-camera at present available is the Panoram Kodak, introduced in 1900. This is obtainable in two sizes,—No. 1, for pictures 2¼ x 7 inches, using the regular No. 1 F. P. K. cartridge film; and No. 4, for pictures 3½ x 12 inches, using the regular No. 4 Bull's-eye Kodak film cartridges. Both models are alike in construction and exceedingly simple in manipulation to those familiar with the use of a Kodak. In form No. 1 is a rectangular box measuring 7¼ x 3⅜ x 4 inches; fitted with a swinging lens and



GARFIELD PARK, CHICAGO. GEORGE E. MELLEN

Panoramic view made from three negatives, 6½ x 8½ inches, printed on a single piece of paper according to the method given in article by George E. Mellen. Time, August 28, 2 P. M. Cramer Inst. Iso plates, Ray Filter. Exposure, $\frac{1}{10}$ second for each plate.

shutter, the latter having diaphragm stops Nos. 8, 16, 32 and 64, and a device permitting a wide variation in the speed of the exposure. Brilliant finders, two spirit-levels,—one for vertical and the other for horizontal subjects,—and two tripod sockets are provided. Thus the entire view may be examined before exposure by swinging the camera so as to include the full scope of the view as indicated by the V lines on the top of the instrument. The No. 1 Panoram takes in an angle of view of 112°, while No. 4 includes 142°.

The film when exposed is presented to the back of the lens, in the form of a semicircle, and, in order that the whole length exposed may receive the impression with equal definition, the exposure is made by the lens, which is attached to a sleeve, sweeping round from one side to the other. This being done, the exposure has been effected, all necessary to prepare for another exposure being to set the shutter and wind off the next length of unexposed film.

In order to open the camera for the purpose of inserting films, two small pins are pulled as far as they will come. This unlocks the Kodak, and the back portion slips easily away. The film spool is then placed in its recess, and after being fixed there the paper covering is gently drawn over an aluminum roller, and passes in two grooves over the semi-circular guide, then to be attached at the other end, in the ordinary way, to the empty spool. This being accomplished, the back is again replaced and locked by the two pins already mentioned ; the only other matter to be attended to is, that care be taken to see that the top of the spool comes at the top of the camera.

In going out to make exposures, the key is turned, until the figure 1 appears before the window at the back of camera, then all is ready for work. The speed of the exposure is adjusted by a very simple catch, and allows of two alternative rapidities,—the slower, being that which, under ordinary circumstances, seems to give the better results, the more rapid one being reserved for exceptional work, under suitable conditions of light and subject.

The finder may at first appear rather deceptive, until it is realized that its only object is to show the amount of foreground and skyline which will be included on the film when exposed. The angle of view taken in is seen by the lines marked on the top of the camera in a V shape.

The working of this combination, after one or two exposures, proves very simple, and causes no trouble whatever.

The exposure itself is made by means of a pin, placed in convenient position, which requires but the slightest touch to set in motion the springs, which cause the lens to revolve, and so make the necessary exposure.

The lesser details of manipulation are fully set forth in the booklets sent out with each Panoram Kodak and need not be given here.

The Cirkut

In this review of panoramic cameras we have seen their development follow two distinct lines. In one type the lens is turned alone while the sensitive film is stationary; in the other type the lens is relatively stationary while both camera and sensitive surface move. The former class is limited in angle of view to something less than 180°, while the latter class makes a view through the full circle of 360°. Necessarily, instruments of the first class are of the fixed-focus type, while those of the second class may be of variable focus.

The Cirkut camera, invented by W. J. Johnston and introduced in 1904, belongs to the second class. It is a revolving camera containing a relatively stationary lens and a relatively moving film, the latter moving past a vertical slot through which the exposure is made, and the axis of the camera being at any desirable point between the lens and the film. This construction distinguishes the Cirkut from other panoramic cameras having a swinging lens and stationary film arranged in semicircular form, and means better results, better drawing in the photograph and the practical elimination of distortion.

The Cirkut is at present available in one size only, giving a negative ten inches in width and of any desired length up to twelve and one-half feet—the full circle of 360°. The storage spool holds twenty feet of film, making several exposures possible without reloading, and the daylight loading system is used. When closed, the instrument measures 9 x 12 x 12 inches, weighing eighteen pounds. In use, it revolves on a circular tripod top having a scale marked to permit of the making of negatives of any length required. The lens is of the convertible type, having three foci, respectively (front) 24 inches, (back) 18 inches, and (combination) 10⅞ inches. This range is sufficient for all ordinary requirements, and the change can be made in a moment. A focusing attachment is provided, so that the whole subject can be seen and focused in full size. The length of the negative depends entirely on the focal length of the lens used and the width of the angle of view included; the longer the focus, the longer the negative, and, likewise, the wider the angle, the longer the negative. For instance, using a lens of 24-inch focus and revolving the camera 45° makes a negative 18 inches long; 90°, 3 feet; 135°, 4½ feet; 180°, 6¼ feet, and in like proportion for any angle, even up to 360° (circle), which would be 12½ feet in length. The revolution of the camera can be stopped at *any* desired point and the negative made of *any* desired length less than the maximum, the scale on the tripod top showing at a glance where to stop the camera to make a negative of any desired length.

One pressure of the bulb starts and another pressure stops the revolution of the camera. A notable feature of the Cirkut is the wide variety of exposure speeds obtainable by instant adjustment, the camera being revolved by a spring motor the speed of which is varied by fans of different sizes, and the exposure slot being adjustable in width from ⅛ to ½ inch, giving thereby any speed between ½ and 1/150 of a second. This enables the photographing of nearly every subject, including, in addition to landscapes and stationary objects, fast-moving objects such as athletic events, races, parades, street scenes, etc. The whole negative being composed of continuous uniform exposures made through a narrow vertical slot makes the negatives equally sharp from end to end and enables excellent results to be obtained with the lens wide open.

Other features are a device for raising and lowering the lens, adjustable by the turning of a milled head; and a swinging lens board pivoted at the center horizontally, which gives the same effect as a swing-back and allows perfect control of the amount of sky or foreground included in the view.

We have seen some remarkably good work produced with the Cirkut, and it may be fairly taken as representing the high-water mark in panoramic camera construction. In operation it is exceedingly simple and requires very little more care than an ordinary long-focus view-camera. A caution may be given on the handling of the camera in windy weather, when the wind may possibly operate against the even running of the camera and thus give rise to streaks in the film. As the slower the camera is operated the less liability of streaked films, this would suggest a full-timed exposure of, say, $\frac{1}{6}$ second at *f*/16 with the 18-inch lens, rather than a shorter exposure with a larger aperture under such conditions. In other words, the camera should be handled as one would handle a 14 x 17 or 18 x 22 box with which snap-shots are not expected save in unusually favorable circumstances.

The Cirkut is made by the Century Camera Company, of Rochester, N. Y., and we learn that it is the manufacturers' intention to introduce the camera for smaller negatives in the near future. This is much to be desired, as bringing the capabilities of the Cirkut within the reach of a larger circle of photographers than the present size.

Panoramas With an Ordinary Camera

BY GEORGE E. MELLEN

Panoramic photographs may be made either by means of a special camera and roll of film, or with an ordinary view- or hand-camera, using plates, roll films or cut films. The first method is undoubtedly the more convenient, especially in the making of the prints; but, because of the cost of the special apparatus needed, or manipulative difficulties inherent in the panoramic cameras thus far introduced, seems to be beyond the scope of the average man. Hence we find this method employed chiefly by a few commercial specialists and advanced amateurs. The second method is wholly practical and, although never popularized, has been in use since photography began. It is much simpler than is commonly supposed, and calls for nothing outside of the ordinary photographic outfit except a printing-frame of special capacity.

An Improved Method

In this method of making panoramas, two or more negatives are made in a series, each plate in the series including a portion of the subject included on another. In printing the series of negatives on a single strip of paper, this overlapping portion is blended or vignetted in on each print, so that even with careful examination it is almost impossible to locate the joinings; i.e., to see where the different negatives of the series began and ended. A reference to the frontispiece will make this plain. In the panoramic view in Jackson Park we have combined the three separate sections shown at the right hand. A comparison will show the amount of overlap in each section of the view, and the finished print indicates how the overlapping portions were utilized in vignetting during printing so as to secure perfect joinings at the junction of each section.

The Joining Lines

The first step in this improved method of making panoramic pictures is to mark the "joining lines" on the focusing screen of the camera. The purpose of these "joining lines" is to ensure getting the exact amount of overlap on the adjacent negatives, so that there shall be no difficulty in vignetting one section into another when we come to the printing. These "joining lines" must be drawn exactly parallel with each edge of the focusing screen and at a certain distance from it, this distance depending upon the size of the plate used.

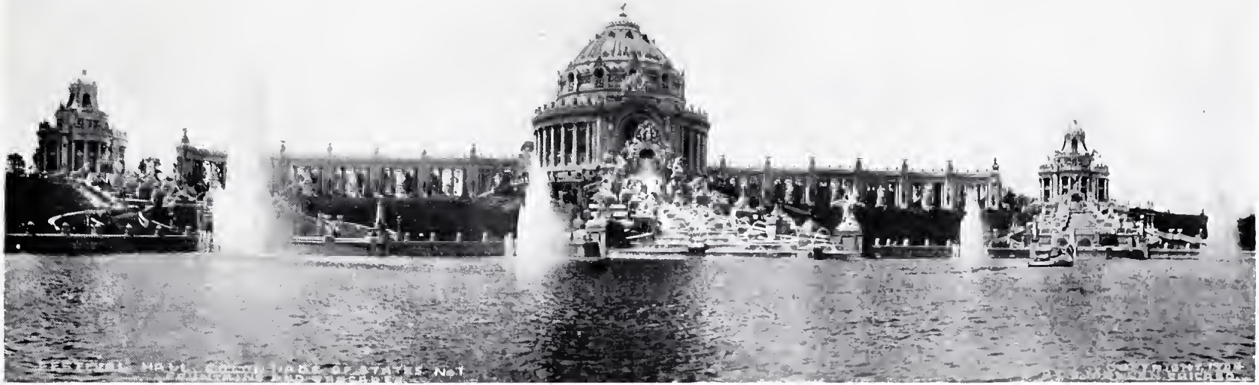
The following table of distances will serve as a guide for the beginner:

For a 3-inch plate, make the line $\frac{1}{2}$-inch from the edge
" 4 " " " " $\frac{5}{8}$ " " "
" 5 " " " " $\frac{3}{4}$ " " "
" 7 " " " " 1 " " "
" 10 " " " " $1\frac{1}{8}$ " " "
" 14 " " " " $1\frac{1}{4}$ " " "
" 17 " " " " $1\frac{1}{2}$ " " "
" 22 " " " " 2 to $2\frac{1}{2}$ " " "

Finder The camera should be provided with a good-sized finder, carefully adjusted to show the exact amount of view included by the lens on the plate used. As few finders are accurately fitted in the first place, this adjustment should be ascertained by actual test. The finder should now be marked with "register lines," corresponding to those on the focusing screen. This marking may usually be done with black ink or pencil on the under side of the ground-glass of the finder, or, where this is impossible, by scratches on the upper glass surface. When a hand-camera is to be used without a tripod, i.e., in the hand, the "register lines" should be marked ⅛ inch from the edges of the finder and, of course, parallel with the edges. In such a case success largely depends upon the accuracy of the register lines.

Tripod When using an 8½ x 6½ camera or larger, the tripod head should be larger than the base of the camera, so as to ensure a good, solid foundation. The tripod also must be perfectly rigid when extended in any desired position, so that when the camera is swung around for each section of the view there will be no possibility of its being tilted or thrown out of level. In this a reliable tripod stay will be found most useful. With small cameras a tripod is not essential; in fact, when making panoramas with the hand-camera, I prefer not to be bothered with the tripod. The St. Louis Exposition panoramas on these pages were secured in this way with a 4 x 5 hand-camera. I have had equal success with my 5 x 7 kodak.

Level A spirit-level is indispensable, for before exposing a plate the camera-back must be absolutely plumb and the base perfectly horizontal. Unless attention is given to this



FESTIVAL HALL, COLONNADE OF STATES, FOUNTAINS AND CASCADES, ST. LOUIS EXPOSITION 1904
Hand-camera panoramic view, original 3½ x 10 inches, from three negatives 4 x 5 inches.
Copyright, 1904, by George E. Mellen

detail it will be difficult to get perfect joinings in printing the complete view. When the level is forgotten, a bunch of keys suspended from the finger by a piece of string will help one to ascertain whether the camera-back is vertical, but such subterfuges are unreliable. The *Ideal Double Level* is the best level I have seen for panoramic work. It should be fixed as close to the finder as is possible with the camera used.

Lenses

The question of lenses is very easily settled, long-focus lenses being very much the best for panoramic work, wherein perspective effects play so important a part. On no account should panoramic views be attempted with a wide-angle lens—using the term in its ordinarily accepted sense. Thus, for the best results, the focal length of the lens should be about one-half longer than the longest way of the plate used: say fifteen inches for 8 x 10 and seven or eight inches for a 4 x 5 plate. The shorter the focal length of the lens, the greater is the deflection at the point of union of the distinct lines of buildings, railroad tracks, streets, sidewalks, etc., included in the view. If the only lens available be of the wide-angle variety, then the rear combination only should be used. This will usually double the focal length of the instrument, but will necessitate about three times the exposure required by the double combination. For landscapes and the like, where there are no cross-lines at the joinings, a lens whose focal length is at least equal to the base line of the plate will serve; but wherever buildings or prominent cross-lines are involved, a rectilinear lens of long-focus will give the most correct and pleasing perspectives.

About Subjects

There is a wide-spread, but mistaken notion that panoramic photography is adapted only for open landscapes or extended views of mountain and lake, exhibition scenes and the like, such as we see in most panoramic pictures. This idea is, doubtless, based on the common practice of confining panoramic work to such subjects. As a matter of fact, the choice of subjects is almost illimitable. Whatever is advantageously displayed in panel or panoramic form — street scenes, seascapes and coastlines, waterfronts of cities, home or factory interiors, cañons and high buildings, large groups, processional motifs, and individuals in different poses, as well as landscapes and mountain or river scenery—each and all lend themselves to the method here discussed.

Point of View

In selecting the point of view for a panoramic subject, two things are chiefly to be considered: first, the composition and lighting of the subject and, second, the question of suitable "joinings." The former is, of course, subject to all the rules of pictorial arrangement and cannot be dealt with here, as it would involve an essay on picture-making. With regard to the "joinings," the one thing necessary is to so arrange the view that the joining of two negatives in the print will not produce an angle where there should be a straight line. Let us take an example. Suppose that we are dealing with a street scene and that we wish to make one negative showing the line of the street running straight across the plate, and the second negative showing a continuation of the same line. If this should come near the base edge of the focusing-screen, on account of the change in the position of the lens, the second negative would present the line running at a different angle across the plate. The result would be that in the finished print the street line would appear to be broken. Therefore, as far as possible, it should be the aim to get cross-lines near the *center* of the plate and the joinings to come at the corners of buildings. If there be a group of buildings and no corner is available, then let the joining come on an oblique line, or a chimney; or, what is better still, on a tree if that be possible. In interiors the same holds true, that is to say, make the joinings at the corner. If one must fall in the middle opposite the vertical center of the object, of a wall, a chair, or other article of furniture should be so placed that the joining will be less evident. In landscapes, where a line of this character occurs in the middle distance, the deflection is so little that it is hardly noticeable and may therefore be disregarded. In groups, the joinings should not pass through faces, but rather between heads and through the clothes. In vertical panoramas of high buildings, the joinings can advantageously follow the decorative bands or semi-cornices at various parts of the façade. It should be remembered that anything which comes outside of the joining or register line will not show in the finished print unless it appears again *inside* of the line on the adjacent negative in the series.

Portrait Panels

Portrait panels or panoramas are as easy to manage as landscapes, provided that a plain and evenly lighted background is used, covering the entire space included in the negative, or at least as much of it as will show in the print. A pair of ordinary light gray wool blankets, placed sufficiently far away from the subject to be out of focus on the plate, make a capital extension ground for amateur work of this sort. For full-figure portraits, lay one-half of the blanket on the floor or ground, extending the other half back and above the figure, fastening in a suspended position. As the background is alike all over the plate, it will blend on the print anywhere between the figures of the different negatives forming the series. This work is very interesting. One can photograph each member of the family separately and combine them in a panel, or different poses of each can be treated in the same way. Similarly a small procession, as a church choir, may be photographed in convenient sections before such a background and the procession reformed in the making of the print.

Vertical Panoramas

In photographing high buildings in narrow streets, or a monument, or the high walls of a cañon, it is sometimes absolutely impossible to get the entire height of the subject on a single plate. In such a case, choose a position near the perpendicular center of the subject and expose two plates or more if needed. Care must be taken here that the ground-glass is absolutely perpendicular and the camera base perfectly horizontal. The joinings, as already mentioned, should be made either at the center of the subject or, in buildings, following the lines of the decorative bands on the façade. If it is possible to get the subject on two plates by moving the lens alone, then the join can best be made at the center. The focus on each half of the subject must be exactly the same, and, when the lens is raised, care must be taken to see that the width of the image at the joining line is precisely the same in both cases. When the exact position is secured, the elevation of the front-board required for each plate should be marked on one of the two standards carrying the lens board.

Copying Plans and Maps

For copying maps, plans and similar flat surfaces, the camera should remain stationary, the object being slid along on the same level for the different exposures required. A long-focus lens is essential to success in this.

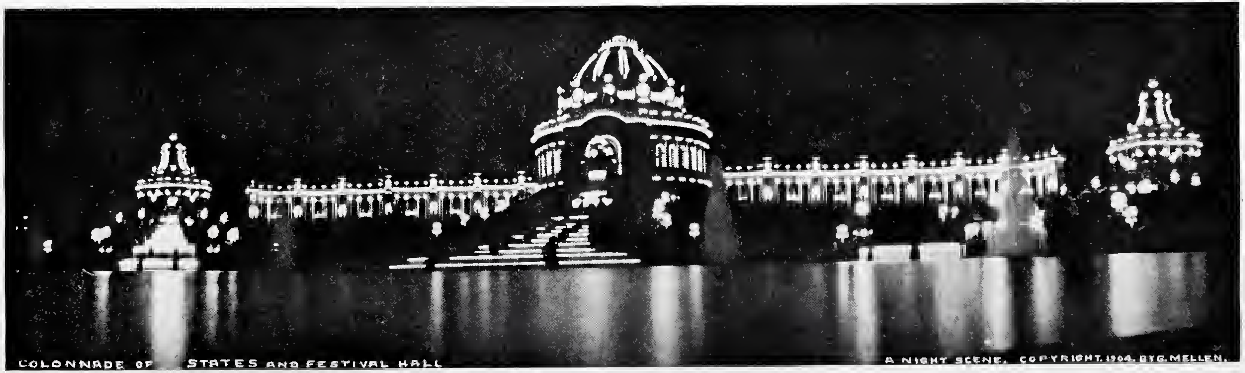
Getting Down to Work

With these preliminary instructions, we can now suppose an actual case and proceed to make a panoramic view. The subject chosen is the view in Jackson Park (frontispiece), and will need a series of three 8 x 10 negatives. We have provided ourselves with a substantial tripod, fitted with a top considerably larger than the base of the camera and a long-focus lens as already described.

The first thing to do is to select the most favorable viewpoint. Next set up the tripod and level the top in every direction. Now place the camera in position and fasten with the screw just as in every-day view work. Theoretically, the best position for the screw is under the lens stop, but practically it is immaterial, as the foreground objects are so far distant from the lens that the difference in the joins will not be noticed in the print.

Now focus the subject and get good definition by using a sufficiently small stop in the lens. Once the correct focus is secured, clamp the focusing screw so that it will be impossible to change it while the different exposures are being made. There will be no objection to the camera front-board being raised during focusing if this is desirable, but tilting the camera itself must not be attempted under any circumstances.

Scanning the subject carefully on the ground-glass, we find that the extreme limit of the view on the right (wrongly numbered 3 in the frontispiece) rests on the left-hand side of the ground-glass. Now look at the right-hand "joining line" on the focusing-screen, and take special note of the particular objects in the view that fall


COLONNADE OF STATES AND FESTIVAL HALL
A NIGHT SCENE. COPYRIGHT. 1904. BY G. MELLEN.

COLONNADE OF STATES AND FESTIVAL HALL AT NIGHT, ST. LOUIS EXPOSITION, 1904
Hand-camera panoramic view, original 3 x 11 inches, from three negatives 4 x 5 inches.
Copyright, 1904, by George E. Mellen

upon the line. Select two distinct spots along this line, if possible near each end, and now turn the camera around until these two spots rest on the left-hand "joining line." If only one spot will fall on the line it clearly indicates that the camera is not properly leveled, in which case this detail must be attended to before proceeding further.

But we will suppose that the spots fall correctly on the line, in which case the position of the camera baseboard should be at once marked with a sharp-pointed pencil on the tripod top. This is to save time and worry when we come to the actual exposure of the plates, for it not infrequently happens that the conditions then are varying, and one must work quickly to get a uniform, general effect. Where a finder only is used, the marking of the tripod top is, of course, not essential.

This is the center space (or Section 2 in the frontispiece) and there is still another join to make. We therefore examine once more the right-hand line on the ground-glass and select another pair of spots. Then turn the camera once more until these spots fall on the left-hand line. Again mark the position of the camera-base on the tripod head (for the third and last section, wrongly numbered 1 in frontispiece) and we are ready to make our exposures.

Exposures

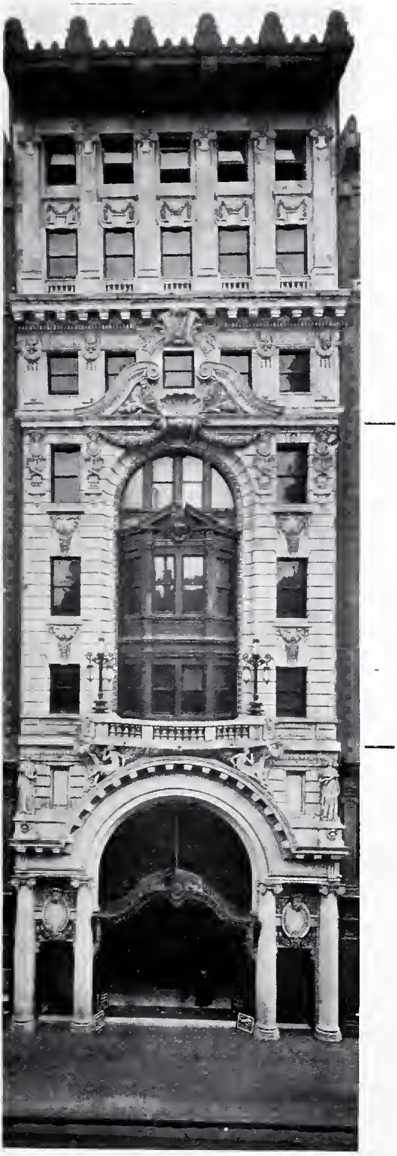
Should the atmospheric conditions be favorable, the three plates can be exposed in a few minutes; but it is not unusual for everything to be just the reverse of what it should be. It may be windy and sunny at one end of the view, and cloudy at the other end at the same time; or it may be smoky in the center of the view and clear at both ends. On a quiet but bright day with sunshine, the lighting on one part may be uniform and flat without a shadow, while the other part may be all in shade. It is evident that with such varying conditions the exposures cannot all be the same, nor can they always be made in rotation as they will appear in the print. Thus one may desire a boating party on the lake before any suitable boating group arrives at the desired point. So we must exercise patience, and just as fast as each section of the view is seen to be right, the exposure for that section should be made on its proper plate, without reference to what has been or may remain to be done.

When conditions are decidedly unfavorable, it is well to make at least two exposures on each section, so as to make sure of a set of negatives which will match without a lot of after manipulation or other troubles.

Development In the development of panoramic negatives, the great point is to secure uniform printing quality in all the plates comprising the series. This means uniform density values and color, both determining the tones in the print. The best way to do this is to develop all the plates in one tray at one time. The Wallace method described in THE PHOTO-MINIATURE No. 66 is well adapted for these requirements, although any "time system" which makes for uniformity of printing quality will serve the same end. Failing the single-tray method, have as many trays as there are negatives in the series, and develop all the plates at the same time in the same developer, allowing all an equal time in development.

While success does not depend on any particular formula, I give here the pyro formula I have used for years with complete satisfaction. It works slowly and gives abundant time for control. Make up two stock solutions: No. 1. Water, 20 ounces; sodium sulphite (crystals), 2 ounces; sodium carbonate (dried), 1 ounce. Dissolve the sulphite first and then add the carbonate. No. 2. Water, 6 ounces; pyro, 1 ounce. To develop a correctly timed exposure take of No. 2, 1 dram; No. 1, 1 ounce; add water 2 ounces. For under-timed exposures vary the developer as follows: No. 2, 1 dram; No. 1, 1½ to 2 ounces; add water 6 ounces. For over-timed exposures, take of No. 2, 2 drams; No. 1, 1 ounce; and add water 6 ounces.

Faking Negatives When the negatives of a series, in spite of careful exposure and development, do not print alike at the first trial, they should be individually "doctored" or modified until they do by means of intensification, reduction, working on the glass side of the negative after first coating with ground-glass substitute, or similar methods



KEITH'S THEATER, PHILADELPHIA

Original 5 x 16 inches, from three negatives

Showing the application of the panoramic idea to the photographing of tall buildings on narrow streets. The joining of the three prints is shown by marks at right side of print.

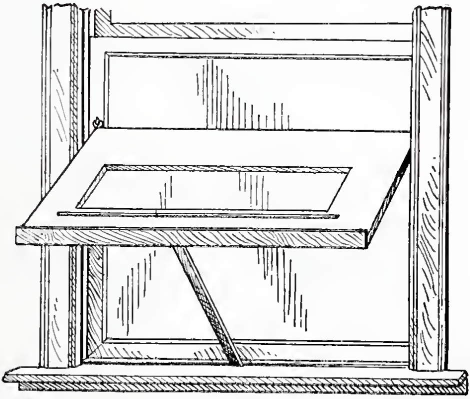
By W. N. Jennings

with which the reader may be familiar. My favorite intensifier is an old one, but it has proved very satisfactory. Make up as follows: No. 1. Bichloride of mercury (saturated solution), ½ ounce; water, 4 ounces. After intensification and washing ten minutes in running water, immerse the plate in No. 2: Sulphite of soda or stronger ammonia water (measured in a graduate), ½ ounce, to which has been added 16 ounces of water. Let the negative remain in this solution until it is clear of the yellow stain of the first operation, after which wash in running water for ten minutes. Before intensifying a dry negative, let it soak in water for a few minutes. Always rock the tray while the negative is immersed either in an intensifier or reducer. If the intensification proceeds too far, the negative can be reduced to any degree by immersion in a weak but freshly prepared hypo solution. My reducer is simply made up as follows: Take of red prussiate of potash a lump size of a pea; of hypo soda a lump size of two peas; dissolve in water 10 ounces. Keep this solution away from strong light, as it weakens rapidly. It can be used for local or complete reduction.

The Examining Board

In preparing panoramic negatives for printing, and equally in doctoring, retouching, spotting, matching or changing negatives before and during printing, we can save ourselves much trouble and work more comfortably by first providing what may be called an Examining-Board. For those who do not possess a large-sized retouching desk this device is abundantly worth the making. As the accompanying diagram shows, it is a home-made affair which can be constructed in half an hour at a cost of fifty cents or less, and is intended to be attached to any convenient window fitted with an opaque blind.

If the window is thirty-six inches wide, the board may be 35 x 15 inches. Along the front edge is nailed a lath, projecting about one-fourth inch above the surface and providing a ledge to prevent the negative or tools from sliding off. In the center of the board cut an aperture 30 x 10 inches (or any other size preferred), and nail a strip of wood one-eighth inch below the edges of the aperture to form a rabbeted panel. Cut a piece of clear glass to fit this recessed panel, and coat it with ground-glass substitute, laying it face down in the frame. Now to the upper corners of the board fasten hooks to engage two sets of screw-eyes on either side of the window, one set holding the board at an angle of forty-five degrees and the other in a horizontal position. To the lower edge of the board hinge a leg or strut to rest on the window-sill and support the board. By drawing down the opaque window-blind and tacking a piece of black



calico to the front edge of the board, we obtain a rough but practical desk lighted only by the light reflected up through the ground-glass panel. A sheet of white card-board, or a piece of looking-glass laid on the window-sill, will serve as a reflector if such additional light be needed, as in working with dense negatives. Note that in working with development or platinum papers at this frame, a piece of yellow post-office paper should be placed between the ground-glass panel and the negative to prevent light fogging.

Preparing to Print

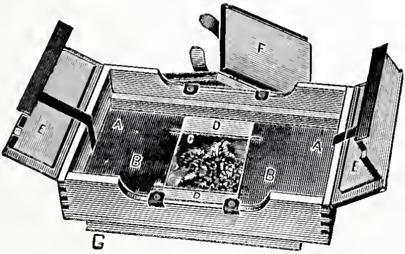
Having provided ourselves with the combined examining-board and retouching-frame described, we can now proceed to prepare a series of panoramic negatives for printing. The first step is to mark off the vignetting or blending lines on the negatives. This is done on the examining-board at the window, all light being excluded save that reflected up through the ground-glass panel. To begin, place two adjacent negatives of the series, film side up, on the glass panel, and lap one over the other until the two "spots," selected as guides during exposure, are directly over each other, and it must be noted that they must come exactly the same distance apart. Now lay a straight-edge over these two spots and scratch the film in a light place, or dot some India ink in a dark place, to the line near the edge of the negative where it will show in the edge of the print. Exactly opposite this mark on the glass side scratch a mark with a glass-cutter or file. This is the register mark for vignetting and must be done on each negative as here described. Should it happen that you have forgotten the "spots" chosen while making the exposures, you will naturally discover about the proper place for the register mark, but to be absolutely accurate you must select two certain points along this imaginary line which will be exactly the same distance apart in each negative. These found, mark with the straight-edge as before.

The Printing Frame

Since we have to use a long strip of sensitive paper and vignette upon it several negatives in succession, it follows that we need a printing-frame of special construction. Such a frame, once its capacity is understood, can readily be made by any one familiar with tools, but may be found in the market ready for use at a moderate cost. The accompanying diagram shows the panoramic printing-frame devised by the writer and obtainable through most dealers. Its dimensions are 6 x 6 inches, for printing from any negative of the same size or less, but frames may be had in various sizes, 8½ x 8½ or 10 x 10 inches, and so on.

In the first place, the panoramic printing-frame has a light-proof compartment at each end in which to store the sensitized paper that is not actually being printed on, and of sufficient size to hold the paper in a loose roll without crumpling it in any way.

The front of the frame, not shown in the diagram, has two adjustable vignetters so arranged that they can be slid to any position across the negative, and held there securely by lever cams or wedges. The distance the vignetters must be from the negative depends on how far the joining line is from the edge of the plate. For instance, suppose while you were making the middle negative of a 5 x 7 panorama you made a mistake and got the joining line only one-half an inch from the edge of the plate, but on the other end you had an inch and a half. Since the blend in every case must not show the extreme end of the negative, where the lap is only one-half inch, the vignetter must be put down closer to the negative than where the lap is one inch or more. And, when it is necessary to do this, the corresponding end of the next negative in the series must have the vignetter exactly the same distance from it, or the joining will not be perfect in the print. A thin strip of pasteboard tacked to the lower side of the vignetter will bring it closer to the plate.



A A with the hinged covers E E closed form small compartments protecting the loose ends of the sensitized paper strip from the light, while one section of the picture is printing under its proper negative. B B are pieces of opaque paper excluding light. C is the negative in position for printing, while D D is a cardboard "kit" extending around under the opaque paper to hold the negative in position. F is the back of the frame and G is a movable tissue frame shielding the negative.

For convenience it is better to have a light supplementary frame covered with one or two thicknesses of tissue paper, which can be readily fastened over the printing-frame or removed as may be needed. The printing-frame itself should be about two sizes larger than the negatives used, for two reasons,—first: one may wish to make upright negatives, and second, if the camera should not be absolutely level during the exposure, the subject will not be straight on the negative and we shall need plenty of room to swing the plate round in the printing-frame to get straight prints. For these reasons frames are usually made square in form, as 6 x 6, 8½ x 8½ and 10 x 10 inches. These dimensions mean the rabbeting, the light-proof compartments at each end being outside of the dimensions given. The rabbet should be deep enough to take a double thick plain glass and a cardboard a trifle thinner than a negative. In the center of this cardboard there should be cut a hole the size of the negative, the cardboard holder so made being fastened securely to the printing-frame by pasting black paper over it so as to exclude all light excepting what passes through the negative alone.

Printing Section One

Begin the actual operation of printing by placing the right-hand negative in the printing-frame. If any light is found to pass through between the negative and the cardboard kit or frame, stick a piece of very thin black paper to the kit and let it lap enough over the negative to cover a little of the image. Then roll up the paper, film side in, holding it in one hand; lay the loose end over the negative and place the roll in its compartment holding it until the cover is closed down over it. Then cover the paper on the negative with a pad of thick cloth or felt that extends each way to the compartment doors. Put on the cover with good pressure and turn the printing-frame face up. Since it is an end negative there is only one vignetting line, therefore push the one vignetter not needed back from the plate. Place the edge of the other vignetter exactly above the two scratches on the negative —the register marks — and fasten securely with the two lever clamps or wedges. Over all put the tissue paper frame, and set out in the sunlight to print. It is preferable to print this class of work in sunlight, not in the shade, and with direct sunlight the frame should stand on end or nearly so rather than on its side, since the sun does not change so rapidly up and down as it does sidewise. Less attention is therefore necessary to keep the frame straight with the sun.

Section Two

The progress of printing is examined in the same way as in ordinary printing methods, except that our examining-board makes the work easier. When the first print is completed, remove the negative from the frame and place the second or center section of the series in position as before. There are now two joining lines, but only one of them has to be adjusted to the print at the present stage. Take off the tissue frame, and push back the vignetter just used. Lay the printing-frame with the negative on the examination board, and then take the print and fit the vignetted edge of the image exactly over the different objects along the corresponding joining line of this negative, taking care that the horizon line in each negative exactly matches in the print regardless of any other lines below it. Hold the paper firmly over the negative until the back of the printing-frame is replaced as before. When the back is properly and securely in position, it is just as well to loosen the spring over the join and again examine to make sure that the paper did not move while the back was being pressed down.

Now turn the frame face up once again, and place the two vignetters over their own register marks. Place to print as before, but it will be necessary to examine the printing frequently at this stage, as the print must be carried to exactly the same depth as the first section printed, otherwise the place of joining will be imperfect.

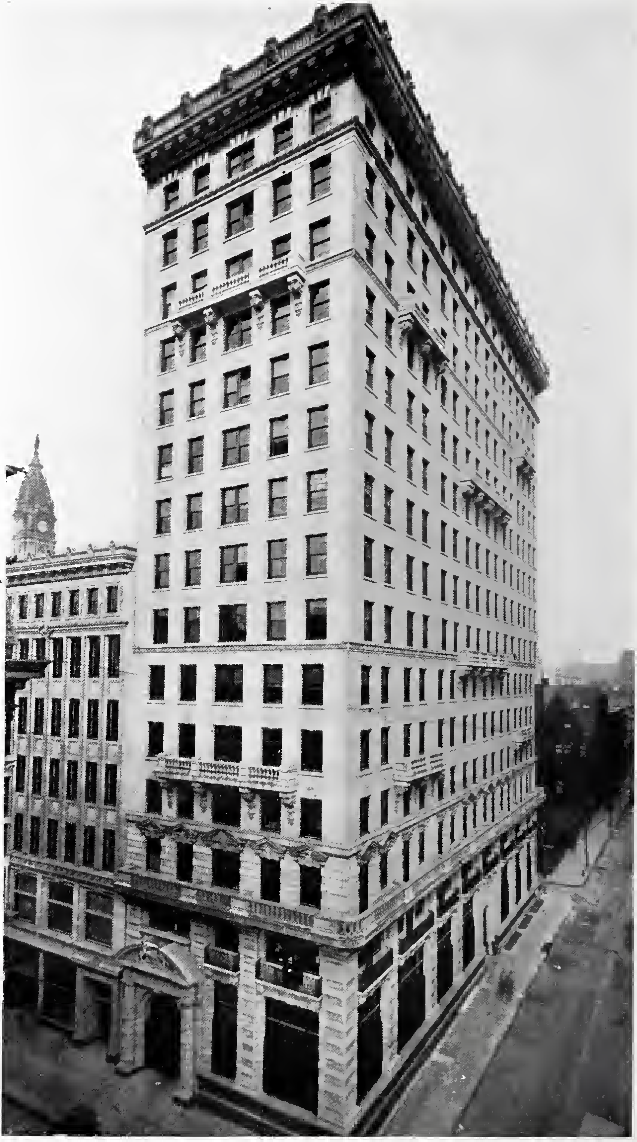
Section Three

When this second section is completed the left-hand or third negative section is placed in position, all the operations being gone through as already detailed for the other sections excepting that there is only one joining line to look after.

As soon as the three sections have been printed to one uniform depth, which will present no difficulty after a few trials, the strip of printed paper is removed from the frame and put aside until the time comes for toning and fixing, which are done in the usual way.

Printing on Development Papers

While the making of panoramic prints on development papers, such as Velox, is not quite so simple as the use of ordinary print-out papers, a very little care and experience will enable the intelligent worker to



COMMONWEALTH TRUST BUILDING, PHILADELPHIA

W. N. Jennings

Vertical panoramic view made from two prints, the joining being indicated by the marks at the sides of print. See article by W. N. Jennings overcome such difficulties as he may at first encounter. In my own practice I use these development papers quite extensively without either trouble or inconvenience. Briefly, the only real difficulties arise from the average worker's lack of familiarity in manipulation. Development papers do not give a visible image in printing, nor can they be handled in daylight.

In working with such papers during the day (and this includes platinum papers), the only precautions needed are, first: exclude all daylight from the printing-room and work with a yellow light sufficiently strong to show all the details and lines in the negative on the paper when both are held together against the light, and second: give extra care to the adjustment of each section joint in changing the negatives of the series. In working at night with gaslight papers, the same instructions apply as in the daytime.

If the window to which the examination board is attached can be completely obscured, so as to exclude all daylight, then the placing of a lamp or electric drop-light under the board and a sheet of yellow glass over the recessed panel in the board will provide all the safe-light we want for changing and adjusting the prints. A well-lighted dark-room will serve the same purpose if provided with a roomy work-table.

To begin, place the printing-frame with the first negative in place against the yellow light. Now lay the strip of sensitized paper on the negative, fastening one end of it only with one-half of the cover. Then with a sharp, soft pencil trace accurately on the back of the paper over the two scratched places in the film at top and bottom of the negative, and on the line between these two points trace one or two cross-lines—first the horizon line, which *must always* match in the adjoining negative. Other cross-lines, especially if they are at the bottom of the negative, may not always join accurately, but should do so very nearly. Now fasten down the other half of the cover and adjust the vignetters as previously explained. To get the exact time for exposure on each negative, make trial prints of each one separately without joining, and mark the time on the margin of the negative for future use.

In making the adjustment for the second negative, go by the tracings at the end of the first section, and when so adjusted fasten that end of the paper down with one-half of the cover as before and trace the marks anew at the other end of the paper as a guide for the adjustment of the adjoining section.

Working with print-out papers, this method of marking the back of the paper as an addition to the other plan of matching makes the operation much easier.

Notes

When printing, regardless of the kind of paper used, if it is found that the vignetter leaves a dark streak across the paper, move it slightly nearer the center of the frame; if a light streak is seen, move the vignetter nearer the edge of the negative. But before making another set of prints see that the register marks on the back of your negatives are exactly in the same place on each adjoining plate, for it is at this point where the trouble lies.

If, in the making of print-out panoramas, one negative of the series is allowed to over-print, do not destroy the print but carry it through the processes of toning, fixing and washing as usual. Then take a clean tray, tilt it upon one side and put a little water in it. Now place the print face up on the inclined bottom of the tray and, of course, higher than the water. Prepare a very weak solution of red prussiate of potash, 10 grains; hypo, 40 grains; water, 2 ounces. Now, with a piece of absorbent cotton, apply this solution to the dark parts of the print very gently, taking care not to rub-up the gelatine surface of the print. The moment it is sufficiently reduced, dash the water in the tray over the part to wash off the reducing-solution and then thoroughly wash the print. This will often save an over-printed section and prevent waste.

Vertical Panoramas

BY W. N. JENNINGS

As the modern office buildings grow skyward, the streets retain their present width and the laws of optics still hold good, so that the photographer of today has troubles of his own when he is called upon to make a picture of one of these architectural nightmares.

When the front and side of a building are to be shown, the employment of a wide-angle lens makes a toboggan slide of the flat roof lines. Only a rectilinear or anastigmat of long focus should be used. In most cases is it almost impossible to get a direct front view of the building, owing to limited space.

Recently I undertook to photograph two buildings of this type on Chestnut street, Philadelphia. The Commonwealth Trust Building has an ornamental band running around it about two-thirds from the base. From an adjoining fire-escape I pointed the lens downward and lowered the front-board to its limit so as to include the base of the building, and made one negative; then pointed the lens upward and raised the front-board to its top limit so as to embrace the image of the roof, for another negative; being careful, of course, to keep the swingback in a vertical position. By making two prints and carefully trimming around the projecting-band, they matched perfectly.

In another case (Keith's New Theater) a straight-front view was required,—the street is only sixty feet wide and the theater is a very tall one. Here I used a medium-angle lens; made one exposure from the second-story of a building directly opposite; another from a fourth-story window, and a third from the roof; being careful to place the camera in the same vertical line, the same distance away from the theater, and without change of focus.

By careful matching of lines on the focusing-screen and trimming the prints, I had no trouble in getting good photographs of the buildings without distortion.

Since this experiment I have had occasion to do similar work in this class, and the resulting composite picture always gives satisfaction.

Panoramic Views in Separate Sections

As an alternative method of making panoramic views with an ordinary camera, we may secure a series of two, three or more negatives as set forth by Mr. Mellen on another page, and, instead of combining the negatives in one unbroken print on a single strip of paper, make separate prints from each negative and mount them side by side, separated by a narrow space. The choice of subjects available with this method is, of course, more restricted than with the improved method described by Mr. Mellen; but if a mount of neutral tint be employed the results are very effective and, in some instances, altogether satisfactory.

This method is explained by Mr. F. C. Lambert, in the *Amateur Photographer*, as follows:

Presuming that we have selected our standpoint—say, on some hilltop, and we are about to depict a long sweep of country extending some one hundred and eighty degrees or so. The first thing is to set up the tripod *firmly*, so that the camera can be rotated on the camera screw without any possibility of one or other of the legs sinking into the ground.

Adjusting the Camera

The next point is to see that the tripod is truly level, so that the camera as it rotates moves in a horizontal direction. If you do not happen to possess a level, a very fair substitute may be extemporized if you have at hand a bit of string. One end attached to a bunch of keys, or caught by the short blade of a pocket-knife, and the other end held by the fingers gives us a vertical or plumb line. First set the tripod as near level as you can, then fix the camera-back vertical, using the plumb-line held near one edge as a guide. View your camera-back first facing the ground-glass, i. e., from the back, and then from the side, i.e., facing the bellows. Now rotate the camera through (about) a right angle, and test again, and repeat after another like rotation. Do not be satisfied until you have got the tripod and camera so adjusted that the edge of the reversing frame is parallel to your plumb line, in three positions of the camera at about right angles to each other. The next thing is to adjust the focus, stop, etc., so that all of the (say four) views will be taken with the same exposure, stop, etc., without any readjustment of the camera between them except that of rotation. Now settle upon the position of camera for first view, and note carefully some object, e.g., tree trunk, which comes about a quarter of an inch from that edge of your picture which comes next to portion No. 2.

Having exposed plate No. 1, then rotate the camera so that you have the previously noted tree trunk again just well within (an eighth to a quarter of an inch) the view (now, of course, on the opposite end to that of No. 1), and in like manner observe some other easily recognized object about the same distance from the opposite side, say, a haystack. Make the second exposure, and then rotate the camera again until the haystack occupies the opposite edge of the ground-glass, and so on.

Development

The negatives should subsequently be all developed together, so as to obtain, as far as may be, the same density contrasts. On printing them, we shall have a duplicate strip of the view between each adjoining pair so that there is an overlap. The object of this is two-fold; first, to prevent any gap in the panorama, and, second, to give us a little trimming margin in case the edges of the plate are at all defective.

Mounting

The first and most natural impulse is to mount the prints edge to edge, so as to try to produce the effect of one long print. Experience, however, shows that the cut edges will always show, and this will be enough to convey the impression that it is an *attempt* and a *failure* to produce one long print.

It is, therefore, far better to face the situation and not attempt any joining, but rather to leave a narrow gap between each print and its neighbor. This gap may conveniently be from an eighth to a quarter of an inch. The eye unconsciously "jumps" this space, and is satisfied that no attempt to deceive has been made. A faint pencil line may be run all around the various portions, binding them together, and help the feeling of several parts which belong to each other.

The Overlap Mounting Method

The view of the Harbor of Valletta, which forms the frontispiece of this issue, was made after the method here explained, with the exception that the various prints from the series of negatives were mounted so as to actually overlap on the mount. In such cases the plates employed must be considerably larger than the finished print of each section, in order to allow for such trimming as may be required to get perfect joinings where one section overlaps its neighbor. With care in the negative-making, this overlap-mounting method gives very satisfactory panoramas, as is seen in the view by Mr. S. L. Cassar, wherein the joinings are hardly observable. The original from which our reproduction was made measured 52 x 6½ inches, being made on five 10 x 12 plates. The angle of view included is 120°.

How to Make a Printing-Frame

BY L. L. COOLIDGE

Not having the two to five dollars to spare for a combination printing-frame, and desiring to try our hand on a 4 x 20-inch photograph, and finding when printed separately from each negative and joined together on the card, the finished picture did not look as well as work done with a combination frame, we decided to make one ourselves. We were just one hour in the making, and this is how we made it: Take a printing-frame, say a 4 x 5, as we did, and cut down the ends to within just the thickness of a glass plate (Fig. 1, A A). Now, hunt up a pasteboard mailing-tube about two inches in diameter. Cut two pieces, each five inches long, or the length of the width of your printing-frame. Cut each tube, lengthwise, in halves (Fig. 2, B B). Paste a piece of black cloth over the cut tube to make a hinge, and so join the two halves together.

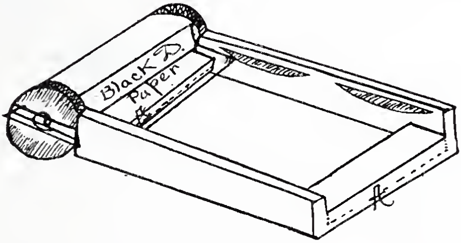


FIG. 1

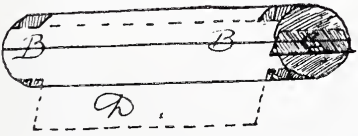


FIG. 2

Close the tube and paste a piece of black paper over each end. When dry, clip the paper through the center, so you can open and close the tube. As these tubes are to hold the printing-paper, they must be made as nearly light-tight as possible. Also, paste a piece of black paper on the upper half of each end of the tube to cover the openings (Figs. 1 and 2, C C). Cut a strip of paper the length of the tube and about two inches wide. Paste the paper (black, of course) on the upper half and allow it to extend over the printing-frame, say an inch or two (Figs. 1 and 2, D D). Make the other tube the same way. Now tack or glue the tubes to each end of the frame and your combination frame is completed. See Fig. 3.

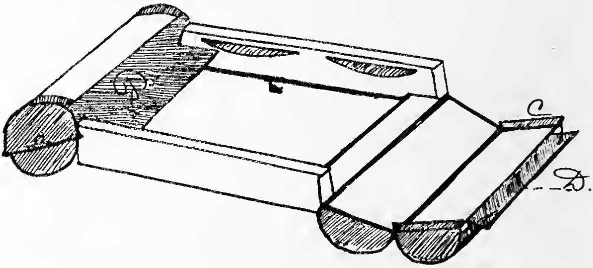


FIG. 3

We have found our home-made frame answers every purpose and protects the paper while printing perfectly. —*Photo Beacon.*

Notes and Comment

The use of artificial light for photographic printing is an interesting matter, now that the days are growing short. Especially is the subject interesting to the professional worker, whose busy season extends from November to April. According to a note in the *Aristo Eagle No. 54*, a photographer possessing the new Aristo Lamp can print a gross of Aristo Platino per hour, running eighteen or twenty frames in the cabinet of the lamp, at a distance of about two feet from the light. This presupposes the help of an assistant to change the frames as needed. According to a note in *Photography*, a Cooper-Hewitt mercury vapor lamp, fitted with four tubes of the usual length, will yield a platinotype print from a negative placed a few inches from the light in from three to twelve minutes, according to the density and color of the negative.

⁂

A new and revised edition of Abney's *Instructions in Photography* is announced from London. This is the standard text-book on photography all the world over, and the present is the eleventh edition. The price of the work has been advanced to $3.75.

⁂

Burke and James, Chicago, advise us that they have been appointed Western Agents for the well-known Expo Camera. This efficient little camera, no larger than a watch, has produced some remarkably good work, and the negatives, no larger than a postage stamp, make capital enlargements up to 4 x 5 inches. Like the Kodak, the Expo uses roll films and can be loaded in the daylight, a 24-exposure film costing 20 cents. It is fitted with a good lens and is simple in its manipulation, forming a very desirable gift for young people and, at the same time, an extremely valuable companion for those going abroad, artists who want to record a chance composition outdoors and inspectors of public works.

❧

The O-H-P Roller Blind Shutter, just introduced by the N. Y. Lens Co., 1133 Broadway, New York, has several novel features which will commend it to the practical photographer. Thus the O-H-P can be used either on the hood or behind the lens and it is set with a key.

❧

Portrait photographers become so accustomed to the use of the regulation portrait lens that many of them seem to be indifferent to the recent improvements which have been made in these objectives. Mathematical and mechanical opticians have not been idle, and the results attained in the recent types of portrait lenses are well worthy of investigation.

Among the more notable of these recent lenses is the Bausch & Lomb Zeiss Portrait Unar. The Unar Lens, as originally designed by the firm of Carl Zeiss, is an objective of the very highest optical corrections and great speed, giving all those qualities which are desired in an objective where perfect definition, brilliancy of image and rapidity are expected. When this lens was placed in the hands of the Bausch & Lomb Optical Company, for manufacture for the American market, a critical examination of its formula disclosed the fact that its systems could be mounted in such a manner that without losing any of its anastigmatic qualities when the systems were in normal position, a slight separation of the systems would give almost any degree of softness and portrait quality. The result of this discovery led to the making of Unar Lenses of much larger size than those originally designed and the mounting of them in the improved mounting which has been adopted for all of the rapid lenses of the Bausch & Lomb Portrait series. This mounting permits the separation of the Iris Diaphragm and focusing attachment and the separation of the lens systems from the rear of the camera.

With the Portait Unar it is therefore possible for the photographer to operate his diffusion attachment so as to obtain just those effects which he seeks while examining the ground-glass and control the diffusion according to the size of head, complexion or texture of the skin of the sitter without loss of time and with the utmost exactness. In addition to this the same objective can be used for groups or for any other kind of photography requiring definition and depth of focus by returning the objective systems to their normal position,

When it is remembered that the speed of this objective, *f* 4, is much greater than that obtained with the average portrait lens in use in the studio, the practical money-making advantages of such an objective will be readily apparent, and we believe that our readers will be interested to have one of the illustrated catalogues, which may be obtained by addressing the company at Rochester, N. Y.

⁂

The Southern Tri-State Photographers' Convention has been postponed until March, 1906 (exact dates later), owing to the stringent quarantine regulations now in force throughout the South. Full particulars of the arrangements, prize-list, etc., can be had from the secretary, M. Ed Wilson, Savannah, Ga.

⁂

The free distribution of sample boxes of plates by the Lumière N. A. Company is a bold bid for public favor and will doubtless bring the response desired. Obviously the best test for a new plate is the practical test by use in the camera, and this test is open to all of our readers who are sufficiently interested to ask for a sample box of the size they use. The Lumière *Sigma* claims to be the fastest plate on the market and especially adapted for gray or dull days and speed work.

⁂

Henry Wenzel, Jr., 81 Keap street, Brooklyn, N. Y., the American agent for the Wynne Exposure Meter and Print Meter, advises us of an unusually large increase in his sales of these specialties since the summer ended. We are using these two meters constantly and can recommend them as altogether practical and efficient.

❧

For some months past we have watched with considerable interest the development of a new line of photographic chemicals. These are now appearing as the Yunit series, manufactured by the Yunit Chemical Company, Rochester, N. Y. The common-sense idea behind the Yunit series is to provide photographers with absolutely pure chemicals, put up in convenient form so as to be ready for instant use without weighing or measuring and other pesky preliminaries. Each item in the Yunit series is put up in measured powders, contained in glass tubes, six tubes to a box, at a very reasonable price. Thus the man who wants to strengthen a weak negative simply takes a tube of Yunit Intensifier and dissolves its contents in two ounces of water, immerses the negative and rocks the tray until the desired density is reached. Then wash as usual. It is all very simple, and does away with much of the bother attaching to dark-room work. The Yunit series thus far comprises the Intensifier, the Yunit Acidifier for preparing an acid-fixing bath, the Yunit Persulphate Reducer, and the Yunit Clearing Reducer. We have given the series careful and extended tests with films and plates, and find them as efficient as they are convenient.

❧

The question of teaching photography in the public schools was recently agitated in the New York *Sun*. We republish a few of the letters which appeared on the subject:

To the Editor of The Sun—Sir: As a professional photographer, and as the result of a long academic training, I have a constant interest in art instruction. I would be one of the last to underestimate the value of drawing as it is taught at present—the real mission being not so much the training of the hand to dexterity as the creation in the mind of a love for the beautiful, the strengthening of faculties that make for "good taste."

There is no question that the average child has little or no talent for expression through the hand, and that there is much—and very discouraging—labor wasted in the attainment of the object, i. e., the cultivation of taste. My suggestion is that the camera—doing the drawing mechanically—will enable the child more quickly to arrive at a governed optical consciousness.

The child photographer, under proper instruction, will arrange the visible world into pictorial compositions, and discover the reason why certain arrangements impress one as being beautiful.

I sincerely believe that if photography were taught in the public schools instead of some of the present "frills and fancies," the near future would show a keener appreciation of esthetic qualities than has ever been evident in the American mass. PIRIE MACDONALD.

New York, Sept. 23.

To the Editor of The Sun—Sir: The Japanese children are taught to draw and paint with more ease and rapidity than our children write, and thus a nation of artistic as well as commercially keen people is developed. Might not a thorough training in photography in the school do something similar for our children? If photography were taught as Mr. Pirie MacDonald wishes it to be, we would become more tasteful in our dress and home surrounding and I am sure there would be a smaller percentage of bad pictures in our annual art exhibitions.

Tremont, Oct. 5. MRS. E. B. WALSH.

To the Editor of The Sun—Sir: As a photographer and writer on matters photographic of long standing and familiar with the literature on photography, native as well as foreign, I should like to state that the idea of making photography a feature of the public school system was first suggested by the *Photo Era*, an American magazine devoted to photography, as long ago as 1900, and has been advocated in the pages of that publication ever since.

That paper urged upon the attention of teachers in the secondary grade schools the necessity of using photography as an advanced educational help or appliance for teaching, contending that "as an aid to the teachers of geography, local history, nature study, civics, or as a help to English composition it is of priceless value, and in instruction in drawing without a peer. It trains the eye to line and perspective, cultivates the faculty of observation in a child and teaches it to see the beautiful in common things about it."

I believe that the time is close at hand when the camera will be as necessary a part of a proper school equipment as the spelling-book or the blackboard.

Boston, Oct. 5. WILFRED A. FRENCH.

To the Editor of The Sun—Sir: Cooking, sewing, military drills and photography in the public schools! What next? Why not also amateur theatricals and automobiling?

I have a daughter of thirteen who is in 8A grammar grade who can make stuffed tomatoes but who can't read or write correctly. I went to school in a little village in Wisconsin, where frills and fancies were not known. The curriculum was rather primitive, but I could at least write at the age of thirteen. And I consider that by far more important than any photographic snapshotting.

New York, Oct. 9. AN INCENSED PARENT.

To the Editor of The Sun—Sir: Photography is useful, but other more useful arts can be introduced into our public schools. I would suggest a course in plumbing. This course would teach husbands and fathers to take more interest in their homes and in the welfare of their children. It would lead to improvement in sanitary conditions. It would save some expense for both landlord and tenant. It would tend to reduce high rents. I hope that this suggestion will be considered by the Board of Education. L.

New York, Oct. 10.

Books and Prints

Art in Photography, with selected Examples of European and American Work. Special summer number of *The Studio*, 1905. 160 pp.; illustrated; 8½ x 12 inches; London, 1905. Paper covers, $2. Postage 30 cents additional.

In this bulky volume, gotten up in the characteristically tasteful style which marks *The Studio*, we have the most wonderful collection of pictorial photography ever presented within the covers of a single book. Divided into sections representing respectively the work of Great Britain, the United States, France, Germany, Italy and Belgium, it comprises about one hundred engravings, many printed in colors, and sixteen photogravures. Each section is prefaced by a critique on the work of the particular country to which it is devoted, and the prints are separately mounted on tinted papers chosen to harmonize with the accompanying print. Great care has evidently been given to the reproduction of the examples chosen, and in many instances the reproductions are as desirable as the originals from which they were made.

Necessarily, in the selection of examples for so general a collection, the individual opinion can hardly hope to be wholly satisfied. We confess to some disappointment in the fact that the American section is wholly given up to workers prominently identified with the Photo-Secession. Not that we have any prejudice against the Secession. On the contrary, we hold the movement and its supporters in high regard. But the Photo-Secession is not completely representative either of American photography or the best achievements of American photography. For this reason we regret that the editor of *The Studio* did not go farther afield and give place in his splendid collection to the work of American amateurs and professionals who are content with ideals other than those followed by the Secession. Similarly, we could have wished for a more truly representative showing of the pictorial work of Austria and Germany, in which section we miss not a few names worthy of place. Despite these defects, however, the volume deserves a warm welcome at the hands of all progressive photographers, and we trust that none will miss the opportunity it affords for a better acquaintance with some of the best work of masters old and new.

⁂

The papers on *Gum-Bichromate Printing*, by J. Cruwys Richards, which formed a noteworthy feature in *Photography* a few months ago, have been republished in book form and may be obtained from Tennant and Ward, New York. Mr. Richards is one of the foremost workers in gum by single and multi-coated methods, and his book on the subject is as desirable a manual as the most fastidious can require. The price, in cloth binding, is $1.25.

⁂

A few days ago we spent an enjoyable half-hour in looking through the Washington, D. C., album of prints sent out for foreign circulation by the International Photographic Exchange, of which C. D. Kirkland, Denver, Colo., is president, and Fayette J. Clute, San Francisco, Cal., is the secretary. The album contained about one hundred interior and exterior views, contributed by sixteen members of the Exchange residing in Washington, and gave one an extremely interesting survey of the pictorial and historical attractions of the National Capital. The prints, on Velox paper, varied in size from 5 x 7 to 2 x 2 inches, and were mounted on gray leaves 6 x 10 inches.

Two defects marred our pleasure in the collection. We mention them here only for the helping of such of our readers as may hereafter participate in work of this kind, to which we have always given our enthusiastic encouragement. The prints in the Washington album showed an utter lack of appreciation of the value of the sky in picture-making, being painfully baldheaded, with considerable halation where buildings, foliage or monuments were shown against the sky. Similarly, there was a general failure to recognize the necessity of a level on the camera in making views including strong vertical or horizontal lines. These two points are of vital importance in photographing scenes abounding in architectural detail, as in the photographic survey of a city, and, if neglected in negative-making, should be compensated for, as far as possible, in the making and trimming of the prints.

◆

Bertillon's system for the identification of criminals, by means of photography and finger prints, is cleverly described with illustrations in the November issue of *The Technical World*, Chicago. This system is now extensively used in America, the police headquarters at New York and Philadelphia being completely equipped for the work. In the same journal may be found illustrated articles on "The Making of a Forty-Inch Lens," by John L. Cowan, and "The Congressional Library Book Delivery System," by C. H. Claudy.

◆

We are advised that *Photograms of the Year 1905* will be published in London before the end of October and should be ready for American readers about the end of November. The new volume will offer choice reproductions of pictures by members of The Photo-Secession, exhibits from the American Salon held at New York last autumn and many non-exhibited pictures of merit. New features added this year are illustrated sections devoted to the progress of pictorial photography in Spain and Denmark.

◆

Camera Work, No. XII, October, 1905, recently received, more than sustains the brilliant record of its previous issues. It contains eight Japan tissue proofs in photogravure and two half-tones reproducing the recent work of Alfred Stieglitz, and three Japan tissue proofs in gravure from negatives by F. Benedict Herzog. Of these latter No. III, "The Tale of Isolde," is, in our opinion, one of the most remarkable achievements in modern photography. It represents three draped female figures seated, with the world in space as a background. Two are listening with rapt attention to the tale as read by the third figure. In the arrangement of the figures, the handling of the draperies and as a study in expression, we have seen nothing finer in many years.

❧

From the same number of *Camera Work* we learn that the Photo-Secession exhibition, proposed to be held at New York next spring, has been abandoned owing to the impossibility of securing accurate gallery accommodations at that time. In order, however, to show some of the prints gathered for the exhibition, the Photo-Secession has leased rooms at 291 Fifth Avenue, New York, where continuous fortnightly exhibitions will be given, each exhibition presenting thirty or forty prints from foreign and American workers. The exhibitions will begin about November 1, and will be open to the public without charge. It is planned to make these rooms headquarters for all Photo-Secessionists.

❧

Owing to the absence in Europe of Mr. Alphonse Mucha, one of the three judges of the Goerz Catalogue Cover Design Competition, the closing date for the competition has been extended to October 31. The eight substantial prizes to be awarded in this competition will undoubtedly bring out the best work of many prominent amateurs, and the result is being awaited with widespread interest.

The Eastman International Competition also closes November 1, as far as American competitors are concerned, so that readers who have been working for either competition should send in their work without further delay.

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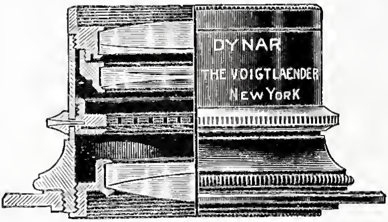

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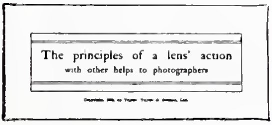

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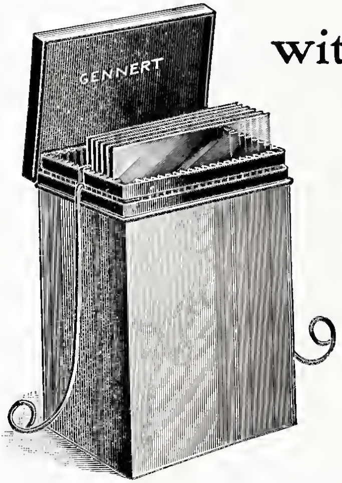
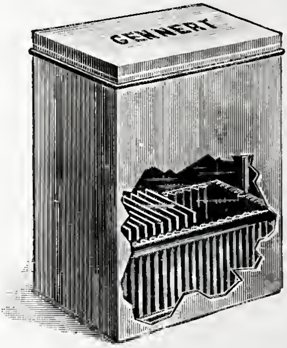


Showing plates raised for examination



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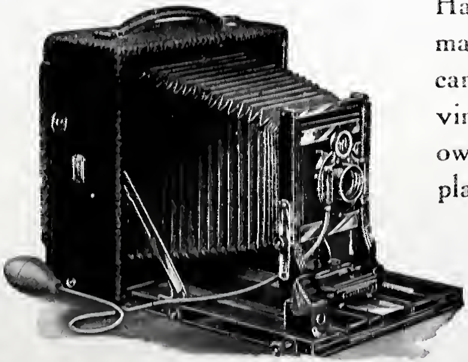

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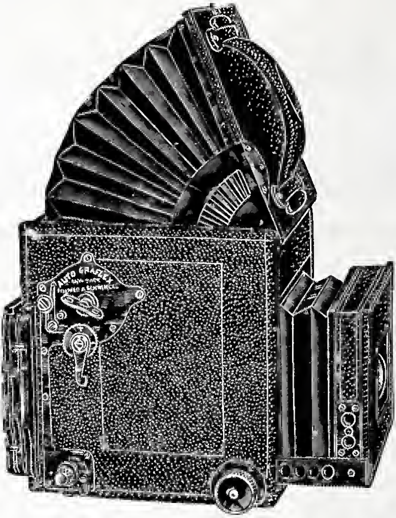

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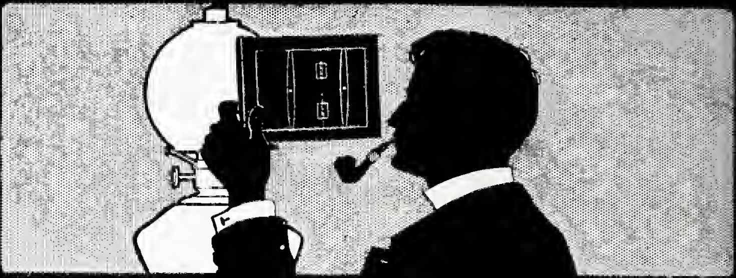

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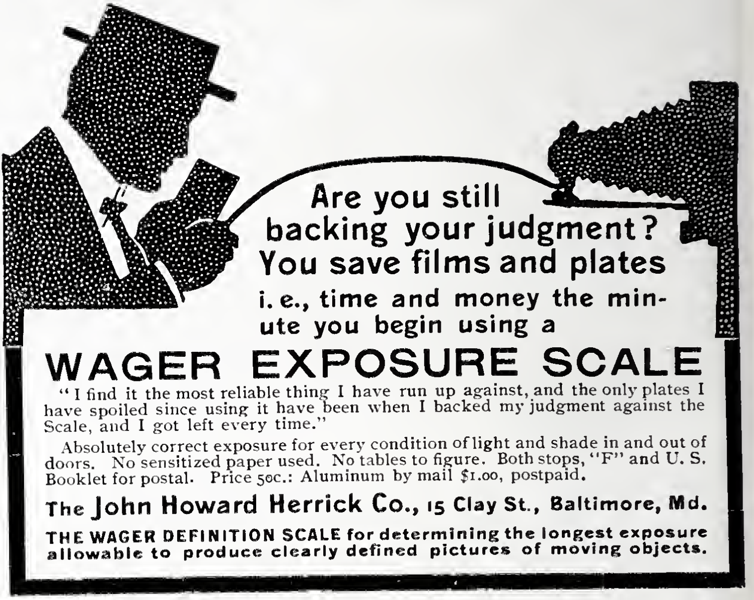

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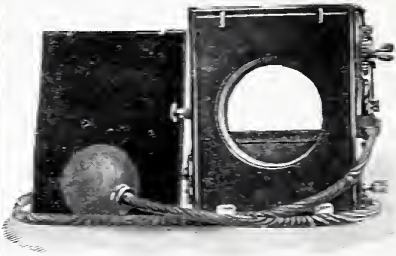

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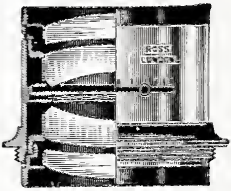

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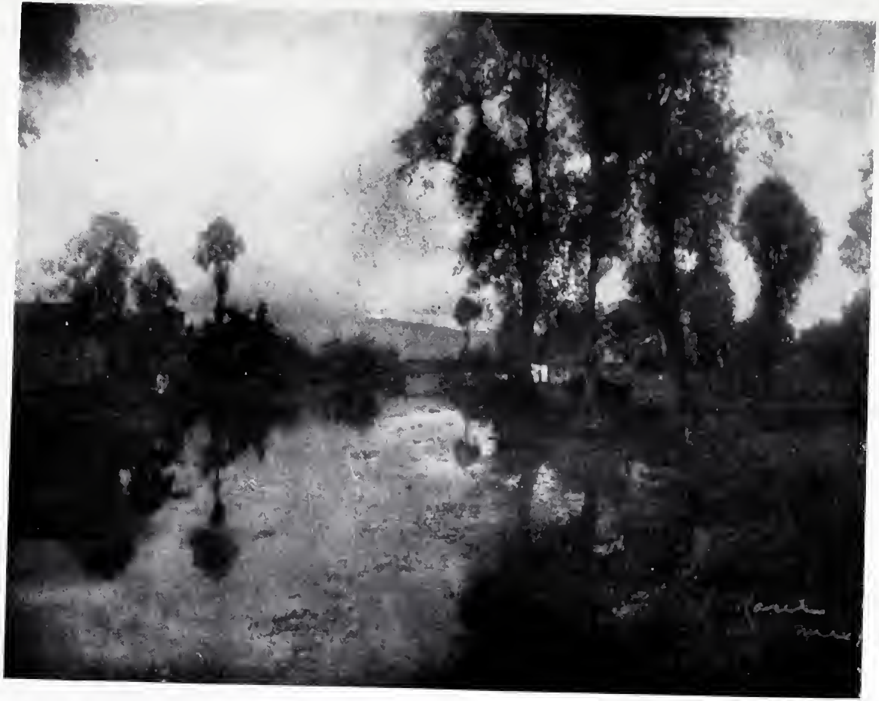

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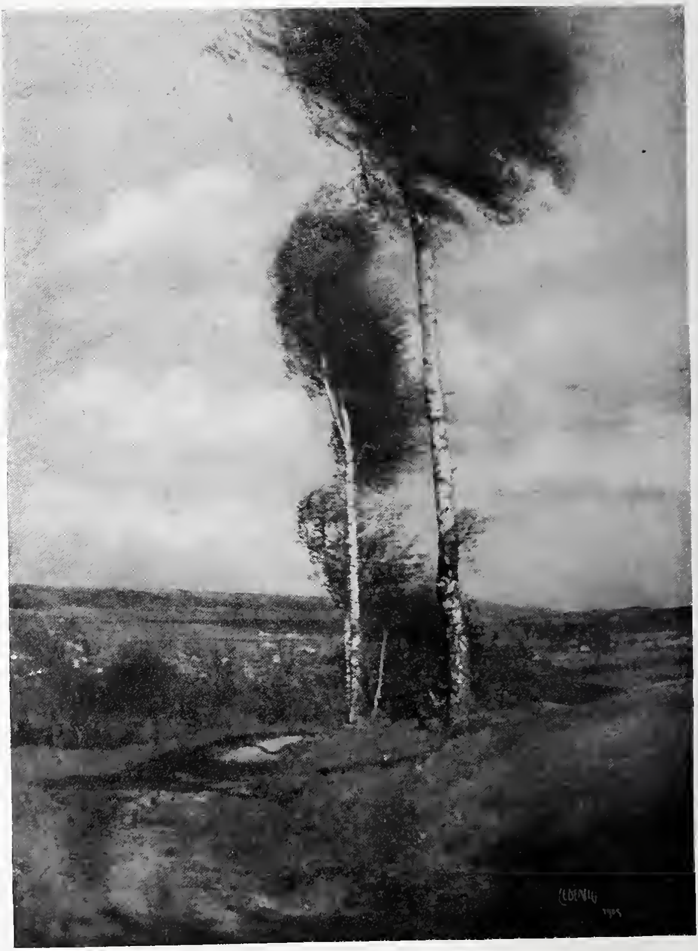

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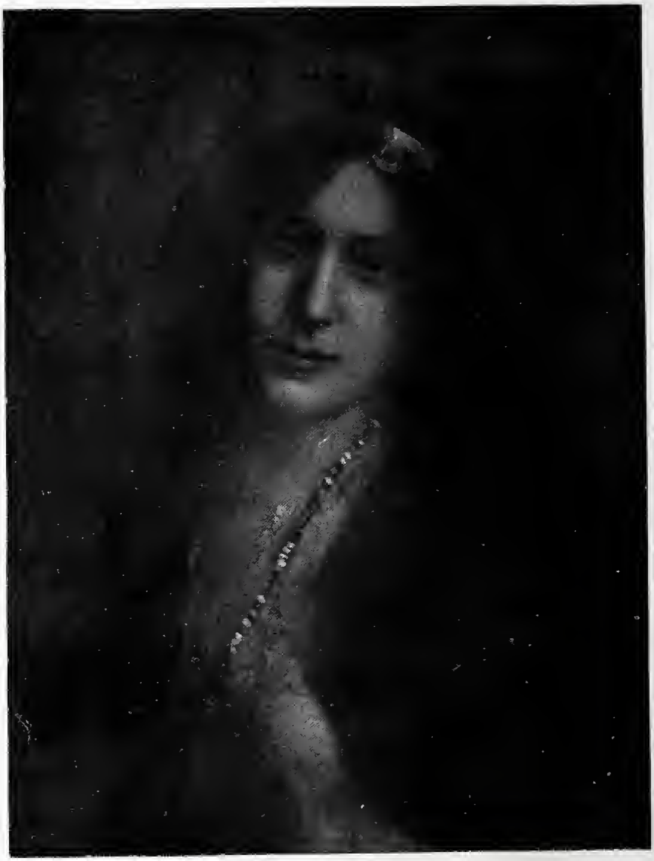

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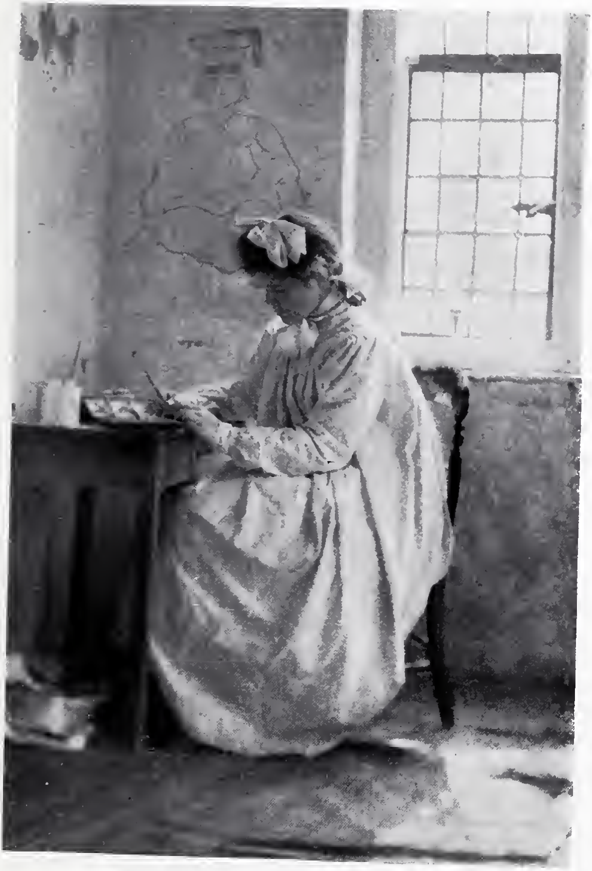

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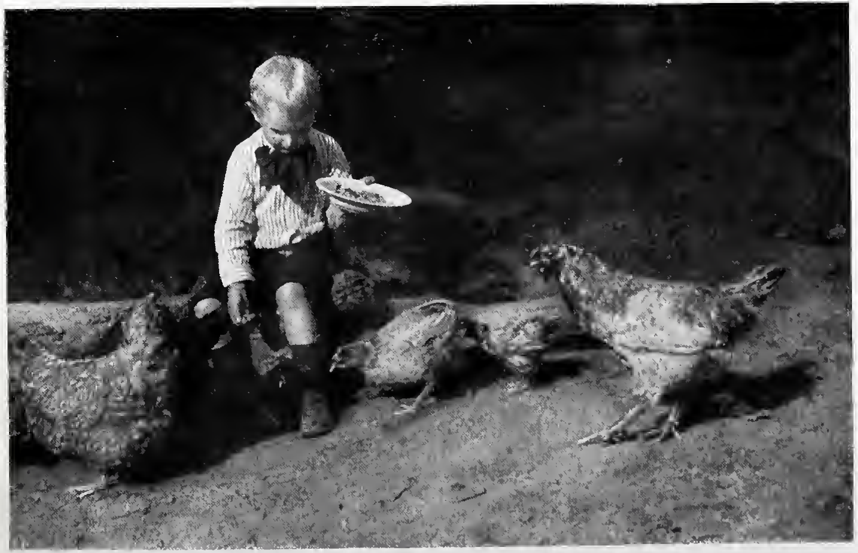

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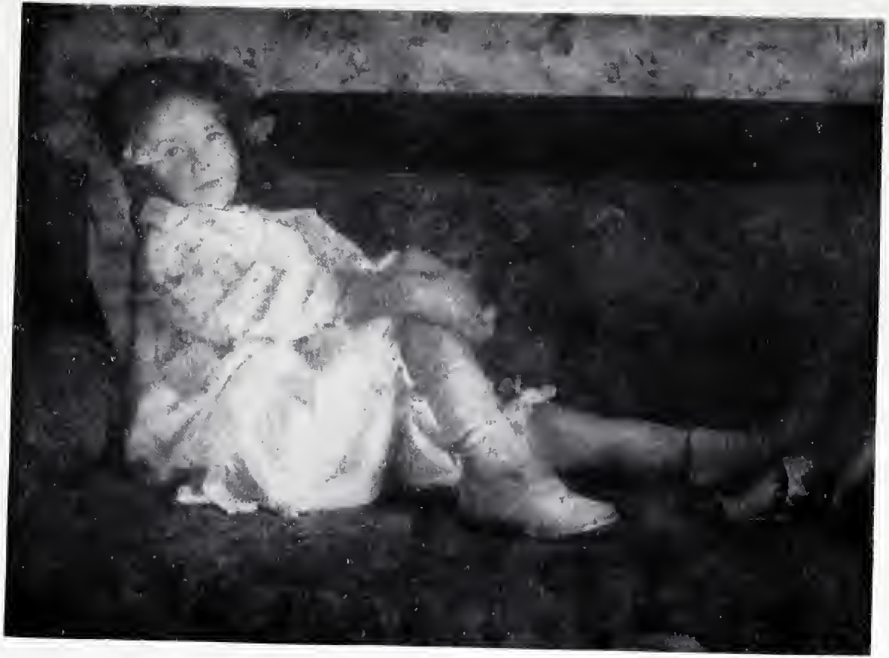

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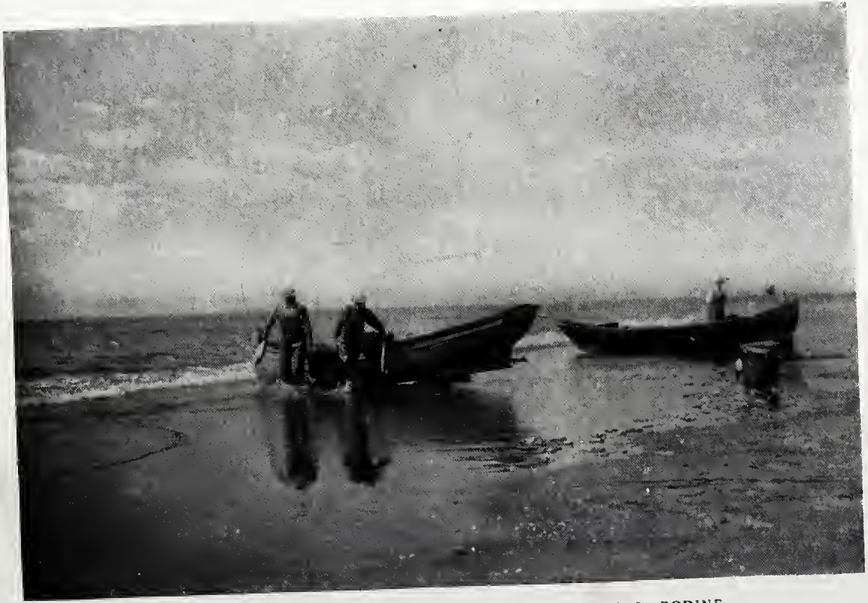

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The Photo-Miniature
A Magazine of Photographic Information
EDITED BY JOHN A. TENNANT

Volume VII NOVEMBER, 1905 Number 74

Intensifying and Reducing the Negative

Because we have been told since the beginning that intensification and reduction are somewhat questionable and uncertain means of remedying negatives otherwise not fit for use, so we have come to regard these processes narrowly—as necessary evils—to be used as a last resort, but, ordinarily, to be shunned as undesirable, if not disreputable.

This is not a reasonable view, and we lose by following it. It is true that faulty negatives can oftentimes be improved by intensification or reduction, and that the last state of negatives so "improved" is sometimes worse than the first. It is obvious, also, that if we could always produce negatives capable of yielding satisfactory prints on any and every sort of printing paper, there would be little need of intensification and reduction methods. But since, in the nature of things, there must always be defective negatives, and different printing papers will always demand negatives suited in printing density and range of contrast to their peculiar characteristics and limitations, so there will always be room for ways and means of modifying the negative considered as a printing plate. Further, as professional and commercial photographers well know, there are certain results which can be obtained more surely by intensification than by modifications in development. Hence it would be wiser and more reasonable to look upon intensification and reduction without prejudice, simply as methods of after-treatment by which we can make our negatives—whether good, bad or indifferent—give us the results we desire in our prints.

The progress of photography confirms the common sense of this view. Undoubtedly, the introduction of new lenses, more rapid plates and perfected apparatus, make the obtaining of good negatives very much easier nowadays than in times past. The development of the Kodak system has also done wonderful things in simplifying photographic manipulation. But these advances, while making every-day practice simpler and more certain, have opened up new possibilities, so that the net result of our progress is marked by a persistent attempt to do things formerly recognized as beyond our reach. As a consequence of this continual straining of methods and materials, photography is as full of uncertainties as ever. The personal equation, always predominant despite factors, systems, machines and correspondence courses, gives birth to an endless variation in results, and few negatives are made which cannot be modified with advantage by some method of after-treatment between the fixing-bath and the printing-frame.

Before we can talk intelligently about any after-treatment, it is desirable that we should recall a few elementary facts about the negative and its purpose. As most of us know, the photographic negative is simply a reversed or "negative" image formed of innumerable particles of opaque metallic silver embedded in a thin film of gelatine. By varying degrees of blackness or density of silver particles (opacity) this negative image more or less correctly represents the different intensities of light and shade in the object photographed. By correct exposure and development, we secure a proportional relation between the varying opacities of gradation in the negative and the light and shade intensities in the subject. This is the perfect negative. But it does not always follow that the perfect negative will give a perfect print,—that is, a print which faithfully reproduces the object photographed, both as regards the delineation of form and the light and shade effects seen by the eye in the subject. This because printing papers differ in their gradation capacity, the difference in capacity being marked even among several papers in the same general class. Thus Goodwin, in a paper read before the Edinburgh Photographic Society early in the year, shows that different brands of print-out paper registered gradations differing as 1 to 64 and 1 to 256. This means that a negative possessing a large range of contrast would have all its tones registered on a paper of the latter kind, while on the former there would be a blocking up of shadows or loss of detail in the lights in prints from the same negative. The gradation capacity of different platinum papers varies in about the same degree as with print-out papers, viz., 1 to 128 to 1 to 400. Among bromide papers the gradation capacity decreases, ranging from 1 to 48 to 1 to 128. In carbon printing it is easily possible to accommodate the sensitive paper to the quality of the negative by varying the strength of the sensitized solution, as well as by keeping the sensitive tissue previous to use.

From this it is evident that a negative may be capable of yielding satisfactory prints with one paper and incapable of giving good prints with another paper. Here is room for some method of after-treatment which will change the quality of any particular negative as a printing plate.

It is also fairly well known among practical photographers that under the best available illumination some subjects cannot be given the exposure required to secure the requisite amount of density by development. This because the amount of density obtainable in development is dependent upon the exposure given the plate rather than upon the time allowed for development. Given sufficient exposure, the density of the negative increases as the time of development is prolonged, but the maximum density obtainable is determined by the exposure. Here, again, intensification offers itself as a means of securing the density required in the negative for this or that printing paper. Similarly there are subjects, such as low-relief carvings and the like, so feeble in their light and shade contrasts that it is generally difficult to get sufficient contrast in the negative to yield a bright or "plucky" print.

There are circumstances where it is impossible to avoid harsh contrasts in the negative, as in photographing machinery in workshops where it is not practicable to control all the sources of illumination. Here the skilled photographer gives a generous exposure and develops for the details in the shadows of his subject, reducing the harshness of the high-lights by means of a reducer whose action is more energetic in the high-lights than in the shadows of the negative.

In the following pages the reader will find all the best information available concerning intensification and reduction. A comparison with the methods given in No. 15 of this series, published five years ago, will show substantial progress in the right direction, viz., toward greater certainty in manipulation and results. Some of the earlier processes are republished, as still retained in the present-day practice; but we are a little behind the rest of the world in this particular branch of photographic technics and can profitably give more attention to the newer methods. Among these, the mercury-ferrous oxalate process perfected by Mr. Chapman Jones deserves special mention as the only logical method for those who still cling to the mercurial processes. There is no room for doubt but that this method is the most easily controllable, the most certain in action and the most permanent in results of all the mercurial methods. The redevelopment methods advocated by Messrs. Baker, Teape, Piper and Carnegie mark a new era in intensification, and they will doubtless arrest the attention of the progressive reader as worthy of extended trial and practical test. Unless we are mistaken, these redevelopment methods will eventually replace the earlier and more cumbersome processes. The silver intensifier, as given by Mr. Jarman, has proved itself in our hands to be the most desirable of all the silver methods, and the additional paper by Mr. Bennett leaves little room for failure in its use on the score of misunderstanding. The other standard methods and formulæ included have been gathered from thoroughly trustworthy sources and may be relied upon in practice, despite the disproportionate amount of the same ingredients appearing in different formulæ.

Turning to methods of reduction, progress is not so well marked. We have arrived at a fairer estimate of ammonium persulphate than was possible a few years ago, and it is now seen to offer a valuable alternative to the hypo-ferricyanide process so long associated with the name of Howard Farmer. The cerium peroxide method has been revised to its advantage and is now a favorite process with many workers.

Before attempting the intensification or reduction of a negative it is essential to success, with almost every method given herein, that the negative under manipulation shall be thoroughly free from hypo, chemical stains, grease or finger-marks, retouching or other varnish, and every other agent in the film which can in any way interfere with the uniform action of the intensifier or reducer employed. The exceptions to this rule will be noted as we go along, but it is important to realize in the beginning that nine-tenths of the failures encountered in the use of after-treatment methods result from a lack of care or thoroughness in the preparation of the negative for the method of after-treatment used. The easiest road to success, therefore, with any method, is to take every possible means to secure in the beginning a clean film of gelatine holding an image consisting wholly of metallic silver, free from fixing salts or other chemical impurities likely to interfere with the action of the chemical agents composing our intensifiers or reducers.

It is important to note, also, that the physical character of different plates and films varies considerably. Some emulsions are hardened in their manufacture, being tough and impervious to solutions. Others are soft and more or less porous or absorbent, responding readily to chemical treatment and the action of solutions. This explains why some plates are said to be capable of intensification without much washing after fixing. Such plates are probably coated with a soft emulsion, and very little washing suffices to thoroughly free the film from the fixing salts and by-products.

In my own experience, I have encountered more difficulty in the intensification and reduction of Kodak films than with many brands of glass plates. Evidently the emulsion used in the manufacture of Eastman films is harder than that employed by other manufacturers, so that it is advantageous to soak the film negatives for some time before attempting intensification or reduction. On the other hand, many emulsions are liable to disintegration if subjected for too long a time to the action of certain intensifiers and reducers. The characteristics of any plate or film in this respect will be quickly learned by a little experience. The moral of it all is, to experiment with worthless negatives before risking any valuable plate or negative with an intensifier or reducer of which our knowledge is limited.

Recent Advances in Methods of Intensification

BY J. THORNE BAKER

The mercurial methods of intensification are far more numerous today than they were a few years ago, and the effects of different baths on the gradation of the negative are sufficiently varied to enable us to deal successfully with all classes of negatives. Nevertheless, the newer methods of intensifying negatives by redevelopment, based on the use of chromium and manganese salts, have much to recommend them to our attention and should not be overlooked in any practical consideration of the subject. In efficiency and economy they are at least equal to the older methods, while the fact that the solutions themselves are not of so poisonous a nature as to render necessary any special precaution in their use will commend these methods to many workers.

Before describing these newer methods in detail, it will be profitable to review, very briefly, the progress made in recent years in mercurial processes, as the actual difference of reblackening the bleached image with the various chemical solutions available for this end has never been too concisely treated.

First, a word of caution. Whatever method of intensification be employed, the negative should be thoroughly washed in running water. Uniformity of action and freedom from fog or stain, the two chief difficulties in all intensifying processes, are chiefly dependent on attention to this detail. The use of soft water is always preferable for this preliminary washing and, in many methods, a few minutes' soaking of the negative in a very dilute acid bath before intensification offers definite advantages. Hydrochloric acid, 1 dram, in water, 25 ounces, will serve this purpose.

In the mercurial method best known, the well-washed negative is bleached in a solution containing 2 parts of mercuric chloride and 1 part of ammonium chloride in 40 parts of water. The degree of intensification obtained depends on the thoroughness of this bleaching operation. When it is judged to be sufficiently bleached for the amount of intensification desired, the negative is again well washed in running water and is then ready for the blackening process.

The solution employed for this reblackening is of vital importance, because we may use a bath which will steepen the original gradation of the negative, i. e., increase its contrast, or, contrariwise, a bath which will soften the gradation and give softness combined with intensification. The first treatment is that best adapted for over-exposed plates, the latter for under-exposed negatives or subjects naturally harsh in their contrasts. It follows that a negative possessing normal gradations may be changed at will to suit any special printing process or paper by the use of either of these treatments, as may be indicated by the requirements of the case.

If it is desired to obtain most intensification in the shadows of the negative, undoubtedly an 8 per cent solution of stronger ammonia water (s.g. ·880) is best adapted to give this result. Care should be taken not to use too strong an ammonia solution, as the bleached image consists of mercurous-silver chloride, probably of the composite formula $HgCl.AgCl$. Ammonia is a solvent of the silver chloride $AgCl$, while it converts the mercurous chloride into a compound which, *in the presence of silver chloride*, deposits metallic silver. In order, therefore, to gain the advantage of the silver, as well as of the mercury-ammonium compound, the blackening or redeveloping of the bleached image should proceed slowly and gradually. But where we want to increase the contrasts of a negative which has been fully or over-exposed, the best thing to do is to bleach as usual and then redevelop with a 20 per cent solution of ordinary hypo. This will give a brownish image, cutting out the shadows to some extent while adding density to the high-lights. In the use of this hypo bath the preliminary soaking of the plate in dilute acid should be omitted.

Turning now to intensification with uranium. It is not generally known that there are two ways of intensifying with uranium so as to obtain either harsher or softer negatives concurrent with intensification. The action of the uranium bath, as is well known, is to enrich the original silver image by the precipitation upon it of some insoluble uranium compound—in most cases the ferr*o*cyanide. But the action is different according as we employ an excess of uranium nitrate or an excess of potassium ferr*i*cyanide, the two active agents entering into the composition of uranium intensifiers.

The uranium intensifier should always be made up in two parts, as the mixed solution quickly decomposes and becomes unfit for use. Two solutions are, therefore, made up as follows: A. Uranium nitrate, 20 grains; glacial acetic acid, 10 drops; water, 1 ounce. B. Potassium ferr*i*cyanide, 20 grains; water, 1 ounce.

If the negative to be intensified is inclined to be harsh in its contrasts from under-exposure, use 3 parts of Solution A to 2 parts of Solution B. In this bath the image becomes bright coppery red in color and the details in the shadows are strongly invigorated. If, on the other hand, the negative is flat and lacking in contrast from over-exposure, or normally exposed but weak from under-development, take 1 part of Solution A to 2 parts of Solution B. This gives desirable increase to the contrasts, the image becoming brownish sepia in color.

In the use of uranium intensifiers, it will sometimes be found that the shadows of the negative are slightly stained with a yellow coloration, which washing will not completely remove. This may be overcome by soaking the negative in a 5 per cent solution of ammonium-sulphocyanide for a minute or two and then rinsing in water.

The fact that a weak solution of sulphite of soda will remove the intensification altogether may be taken advantage of for local treatment when this is desired. The whole negative is first intensified, and then all but the portions which it is desired to intensify or strengthen are gently rubbed over with a tuft or wad of absorbent cotton dipped in the sulphite solution until restored to their original color and density.

We next come to the chromium intensifier or redeveloper, to which reference has already been made. In this method the negative, after a thorough washing, is allowed to turn quite yellow in an acidified solution of potassium chromate. During this process, compounds of the metal chromium are deposited upon the silver image. The plate is then briefly washed, after which it is placed in an alkaline developer and redeveloped to the desired intensity. The developer effects a chemical decomposition of the yellow chromium compounds, and a black chromic substance is thus caused to enrich the original image.

This method is exceedingly simple, cleanly and convenient. An alkaline developer, such as metol-hydrokinone or hydrokinone soda, is usually at hand in most dark-rooms, and potassium chromate and hydrochloric acid, the other two ingredients needed, are cheap and readily obtainable.

The chromate solution is prepared as follows: Water, 2 ounces; potassium chromate, 10 grains; hydrochloric acid (conc.), 5 drops. This solution will keep indefinitely.

The negative to be intensified should first be freed from all traces of hypo by thorough washing. It is then immersed in the chromate solution, where it will be found to assume a bright yellow color within a few minutes. For a medium amount of intensification, two minutes' immersion in the chromate bath will be sufficient. The solution is then poured off (and can be reserved for future use), and the plate is allowed to wash in running water for about three minutes. It is then immersed in a mixture of equal parts of the following developer: A. Hydrokinone, 20 grains; potassium metabisulphite, 20 grains; water, 5 ounces. B. Caustic soda, 40 grains; water, 5 ounces. Although I strongly recommend this particular developer, its use is not essential. Any good metol-hydrokinone or hydrokinone formula may be successfully used. Redevelopment takes place very quickly, so that we can remove the negative after a few minutes and give it a final washing in running water.

There is little chance of failure with this excellent intensifier. In very warm weather or semi-tropical climates there may be a possibility of frilling, arising from the use of hydrochloric acid—an acid which attacks gelatine; but once known, this tendency can readily be obviated by the use of a preliminary bath of formalin or alum, or by slightly reducing the proportion of acid in the intensifying solution.

Similar to the chromate method of intensification is a new process which, I believe, has not been previously exploited, although its simplicity and energetic action upon flat, over-exposed negatives should give it a prominent place among intensifying processes. An acidified solution of potassium permanganate here forms the "bleaching" bath, and redevelopment is effected, as before, with an alkaline organic developer. It seems probable, furthermore, that the permanganate method is similar to the chromate method from a chemical point of view, although we have little doubt that the chlorine set free in the acid solution converts a portion of the image into silver chloride which, on subsequent redevelopment, yields a reduced salt of greater opacity than the original silver itself.

The permanganate solution is prepared as follows: Water, 2 ounces; potassium permanganate, 10 grains; hydrochloric acid, 5 drops. This solution should be freshly made, and made up only in the quantity required for immediate use.

The negative to be intensified, after a thorough washing, is placed in the above solution for one minute to ninety seconds, according to the amount of intensification desired. For well-exposed but rather under-developed negatives one minute's immersion will be sufficient to give a good general intensification. With under-exposed plates in which shadow details are missing or very faint, ninety seconds' or even two minutes' immersion in the permanganate bath can be given safely.

When the negative is removed from the permanganate solution it should be washed in six changes of water. Do not be alarmed because the whites or shadow portions of the negative are quite pink in color. The redevelopment process will restore them to their normal color and condition. After this intermediate washing the negative is redeveloped with the hydrokinone formula already given, or any similar developer. Two or three minutes will suffice to thoroughly reblacken the plate, after which it should be carefully washed and dried.

Another method which, though not of recent origin, has nevertheless not received the attention its efficiency deserves, depends on the rehalogenizing of the silver image by means of an acid solution of copper chloride. The *raison d'être* of intensification here is the greater opacity of partially reduced (developed) silver chloride over that of the original silver image.

In this method the negative is first bleached in a solution made up of: Water, 10 ounces; copper chloride, 100 grains; hydrochloric acid, 80 minims. When sufficiently bleached, wash the plate thoroughly and redevelop with the following developer: Water, 10 ounces; sodium sulphite, ¼ ounce; potassium carbonate, ½ ounce; glycin, 40 grains. If glycin is not available, an amidol developer may be used, though not so successfully as glycin.

To end these notes we shall ask the reader's attention to the useful method of intensifying with iodine. The advantage of this process is that if one is in a hurry (as in newspaper or commercial work) and cannot give the plate that thorough washing essential to the complete removal of the hypo in the film, one can get passable results with iodine where only stains and confusion would result with the other methods.

The negative is well rinsed in water and allowed to bleach in a solution of: Water, 4 ounces; iodine, 15 grains; potassium iodide, 30 grains. When bleached, the plate is again well rinsed and then reblackened by immersion in: Water, 4 ounces; Schlippe's salt (sodium sulphantimoniate), 15 grains; caustic soda, 3 grains. The degree of intensification given is considerable; when complete, the plate is washed and dried as usual.

The various methods here dealt with will be found to give almost every variety of intensification desirable for every-day requirements. By working with each method a few times experimentally, the reader will quickly gain a correct judgment of their respective capacities, influence on the gradations of the negative, etc., and so have at his command all the up-to-date data needed for successful work.

Intensification by Redevelopment

The lack of control and uncertainty as to results attaching to the mercurial, uranium and silver intensifiers in the hands of the average worker, naturally gave rise to continual experimenting in the endeavor to find some way of intensifying gelatine negatives without metallic salts. The earliest practical outcome of this research was the paper read by Mr. J. S. Teape, before the L. and P. P. A. in March, 1904. Mr. Teape gave two alternative methods—one in which the image is chlorized, washed and redeveloped; in the other it is bromized, washed and redeveloped; the former being suitable where only a little increase of intensity is required, the latter where a greater. In these methods there is no risk of stains, and the permanency of the intensified negative is undoubted. Elaborate experiments were detailed by Mr. Teape, and careful comparative results shown. The formula for chlorizing the image is: Potass bichromate, 10 grains; potass chloride, 10 grains; hydrochloric acid, 6 minims; water, 1 ounce. For bromizing: Potass bichromate, 10 grains; potass bromide, 10 grains; hydrochloric acid, 6 minims; water, 1 ounce. The negative may be soaked in water, or may be put into the solutions dry. Allow to remain in the solution a little time after the image is bleached right through, then wash for, say, half an hour, then redevelop with any formula in general use. With a chlorized image, adurol does not give so much increase of density as with a bromized image; with metol, little difference can be detected; pyro-soda, pyro-ammonia, pyro-metol, all give great increase of destiny. Exposure of the bleached image to light before redevelopment accelerates the operation, but does not otherwise affect the final result. Temperature also plays its part; if below 60° F. the action is slow, above 60° it is much quicker. The above redevelopers give the image a brownish color, a color that helps in giving printing density; with hydroquinone the image is black, but the visual density is greater. To intensify the delicate tones only, soak the plate in water, then slightly chlorize the surface of film, wash, and redevelop. A second set of experiments went to show that excess of sulphite in the developer should be avoided, its action being to dissolve some of the silver, but more especially in the chlorized films. Strangely enough, this practical revolution in methods of intensification attracted little attention when published and was in danger of being overlooked.

In October, 1904, Messrs. Piper and Carnegie, apparently unaware of Mr. Teape's experiments, published a somewhat similar method to his in the *Amateur Photographer*.

A few months later (June, 1905) they published a revision of their method, having proved its complete reliability, and also presented a new process employing iodine. The importance of these papers amply justifies their reprint here, and we, therefore, make room for a lengthy extract with due acknowledgment to the *Amateur Photographer*, in which they were originally published.

The Chromium Method

Bleach the plate in one of the following solutions, selecting A, B or C, according to the strength of the intensification required. B is the most generally useful solution, as the resulting intensification is as nearly as possible equal to that obtained with mercury bichloride and ferrous oxalate. The A solution gives a rather more powerful effect, more nearly approaching that ordinarily produced with mercury and ammonia, while C gives a much weaker effect comparable with that of mercury and sodium sulphite. These two mercury processes are, however, so uncertain that exact comparisons are impossible:

	A	B	C
Potassium bichromate	5	10	10 grs.
Hydrochloric acid (s.g. 1.160) . .	1	5	20 minims.
Water to	1	1	1 oz.

Solution A should be made with distilled water.

These three formulæ are selected as the most useful out of the large number available. The stronger the bleaching solution is in acid, the weaker is the intensification, but to obtain the strongest effect it is necessary both to reduce the relative quantity of acid and to dilute the solution. To obtain constant results, the formula must be very carefully adhered to when making up fresh solution. This is especially the case with Solutions A and B, but a little variation will not make much difference with Solution C.

Watch the bleaching process carefully, and as soon as it is complete remove the plate. When complete, the back and front of the image should be of the same uniform color; but if a white porcelain dish is used, the completion of the process can be readily observed from the front of the plate by noting the disappearance of the last tinge of grayness. It is advisable to gently rock the dish during the bleaching process; this hastens the action of the solution and ensures an even effect.

Very prolonged immersion in the bleaching solution seriously diminishes the ultimate intensification, but this effect is not very appreciable unless the proper time is greatly exceeded. One hour in B will give about the same density as one minute in C, but the proper time in B is about two minutes, and an extra minute will make little difference, though any excess is inadvisable.

The color of the bleached image is a brownish buff, Solution A giving the darkest image, and Solution C the lightest. The freshly bleached image is covered with a bright yellow stain from the bichromate solution, and it must be washed under the tap until this stain disappears. Washing may take from ten to thirty minutes, and when complete the image is redeveloped with amidol, using 5 grains of amidol in one ounce of 10 per cent sulphite of soda. The developer should be freshly mixed to avoid stains, and it is quite sufficient to roughly measure the dry amidol.

The whole operation can be carried out either in light or in darkness with the bleaching solutions recommended. The plate need not be exposed to light before redevelopment, and, in fact, it is as well to avoid prolonged exposure and to develop as soon as possible after washing. After the redevelopment, thirty minutes' washing is sufficient.

Washing is all that is absolutely necessary after development, but a small residue of undeveloped silver salt may remain in the film, and the brief application of a hypo bath will then slightly clear the image and produce a cleaner result. It will not affect the density to an appreciable extent, unless development has been cut too short. The time of development need not, however, exceed from three to four minutes, and the process is generally complete in less time. We do not specially advise the hypo bath, as its effect is generally quite unappreciable, and its use necessitates longer washing. To avoid stains, keep the plate perfectly covered with the developer, and do not develop in bright sunlight; such a proceeding is quite unnecessary if the plate has been previously exposed, and strong light facilitates the production of stains.

Washing after the bleaching operation is the most lengthy part of this process of intensification, but it can be considerably abbreviated. Wash in a dish under a good stream of water until the greater part of the yellow bichromate stain has disappeared — one or two minutes is generally sufficient to produce this effect — then remove the rest of the stain by pouring repeatedly on and off the plate a 2 per cent solution of potassium metabisulphite. The metabisulphite solution must not be stronger than 2 per cent, and the plate must not be allowed to soak in it, otherwise the density will be diminished. Fresh metabisulphite solution should be used for each plate.

The bichromate bleaching solution will keep indefinitely if not used, but it deteriorates slowly by use. A stock bottle should be kept, and the amount required for use (about two ounces for quarter plates), may be put into a smaller wide-mouthed bottle and used repeatedly until its action begins to slow down. One quarter of its bulk should then be thrown away, and an equivalent quantity of fresh solution from the stock bottle can be added to the working bottle.

It must be particularly noted that the precise amount of intensification reached depends absolutely on the proportions of the bleaching solution. The formula B given will produce a useful degree of intensification equal to, or perhaps slightly greater than that given by mercury and ferrous oxalate (when a 5 per cent mercury solution acidified with hydrochloric acid is used), but less than that produced by mercury and ammonia. This formula will not produce the maximum intensification in one operation; we have, however, found that the process of intensification with Solution B above may be repeated an indefinite number of times. Two intensifications with the solution described give an effect about equal to that produced by mercury and ammonium sulphide, while three give more density than is likely to be required. On account of the uncertainty of the results of the various mercury processes, an exact comparison is impossible. The fact that a given density can be attained either by repeating the process or by employing a modified solution, is one of great practical value, as enabling the worker to reach any desired result gradually with complete control at each stage.

When the process is repeated the developer must be washed out completely before reapplying the bleaching solution, otherwise stains will probably appear. The first bleaching gives a nearly white image, but each repetition gives a darker result, and the color gradually becomes a yellow-brown. This may be readily distinguished from the bright bichromate yellow stain which exists when washing is incomplete.

The Iodine Method This process appears to be really a new method of intensification, as, for some reason difficult to understand, most writers seem to have hitherto assumed it to be an impossible one. So far from being impossible, it is a very easy method that we can highly recommend for negatives in cases where an intensification about equal to that produced by mercury and sodium sulphite is desired. It is a much more reliable process than the mercurial one, and gives results the permanency of which is beyond suspicion; moreover, it is very quickly carried out. It is a strictly non-metallic process of intensification, and, as we find to be the case with all such processes, there is no extra gain on repetition if the first redevelopment is carried as far as it will go. It is applicable to any negative or positive imagine on bromide emulsion plates, but it does not appear that it can be successfully applied to the extremely slow chloro-bromide plates.

Bleach the image in the following solution: Iodine, 7½ grains; potassium iodide, 15 grains; water to make 2 ounces.

In making up the solution, weigh out the iodine and potassium iodide separately, and then mix them in the dry state. Moisten with a few drops of water and when the iodine is dissolved dilute to the stated total volume. The solution will keep indefinitely, and can be used many times over. It does not appear that the exact formula is of any consequence, as the proportions of the ingredients can be varied considerably without making any appreciable difference in the result. The formula given is, however, a convenient one, as it works very rapidly. It stains the film, but that is not a matter of any moment, as the stain is completely and rapidly removed by the developer recommended.

The image bleaches almost immediately—in a few seconds with a fresh solution—and the completion of the operation is observed by examining the back of the plate. After a slight rinsing under the tap, the plate is immersed in a hydroquinone and caustic soda developer, and left until all stain has completely disappeared. This will take less than a minute, provided the plate has not been left in the bleaching solution so long as to be very violently stained. When the image is perfectly white and clear, the plate is lifted out of the developer and four inches of magnesium ribbon is burnt on each side of it, the ribbon being held about two inches from the plate and waved about so as to secure fairly even illumination. The plate is then replaced in the developer and rapidly blackens. The progress of development is somewhat slow, and full density is not attained until about five minutes after the image is perfectly black on both sides of the plate. It is generally advisable to develop for about ten minutes altogether, and after that half an hour's washing is ample. The actual intensification process is complete in about fifteen minutes, and as it is quite unnecessary to rock the dish or watch the progress of development, the personal attention of the operator is necessary only during five minutes of that time. A greater quantity of ribbon should, of course, be used for plates over quarter-plate size.

The procedure described must be adhered to exactly, otherwise the image will probably fail to redevelop. It does not appear that any other developer can be used with such satisfactory results, but the precise formula is perhaps not a matter of much importance. It seems that the presence of potassium bromide is an assistance rather than otherwise, and we find that the Imperial formula for the process plates works excellently. We, therefore, give this formula to save reference:—

No. 1.—Hydroquinone, 150 grains; potassium metabisulphite, 10 grains; potassium bromide, 50 grains; water to make 20 ounces.

No. 2.—Sodium sulphite, 2 ounces; caustic soda, 100 grains; water to make 20 ounces.

For use, take equal parts of Nos. 1 and 2.

If the very brightest summer sunlight is available, the plates may be exposed to it instead of using magnesium, but in all cases we prefer the use of the artificial light.

Mercury and Ferrous Oxalate

BY CHAPMAN JONES

Among the mercurial methods of intensification, the mercury and ferrous oxalate process, so persistently advocated by Mr. Chapman Jones, undoubtedly takes the first place. We republish below the official description of the method, given by the author in the *Amateur Photographer*, March 23, 1903.

It may be worth while to briefly point out the advantages of the process, and why it stands alone. It is the only method that has been proved to give permanent results, while the greater number, if not all, of the other generally known methods have been shown to give negatives that cannot be depended upon to remain without change. It is the only method that has been shown to give strictly proportional results, that is, to produce always the some effect, an effect, therefore, that can be certainly foretold. The other usual methods give different effects according to the variations in their application, time, dilution, and so on, and do not produce an equally proportional effect in the various parts of even the same negative. The delightful certainty of the process, as soon as the photographer once gets into the way of applying it, that is if the photographer cares for photography, generally leads to its adoption as the standard method.

Three solutions are required: 1. MERCURIC CHLORIDE (*a saturated solution*). Add strong hydrochloric acid, ½ dram to each pint; or 3 drops to 2 ounces; or 3 c.c. to each liter. This solution must be prepared in quantity sufficient to well cover the largest plate to be treated, and may be made by simply putting the powdered mercuric chloride (corrosive sublimate) into the water and shaking it up a few times. What does not dissolve may be left at the bottom of the bottle, and will be gradually taken up as the solution is used. The solution after use may be returned to the bottle and will last indefinitely.

2. POTASSIUM OXALATE (*a saturated solution*). This solution also will keep as prepared indefinitely, but cannot be preserved after use, except, perhaps, for immediate use a second time, as stated below. Those who have not the conveniences of a laboratory may conveniently prepare this solution by tying up about half a pound of the salt in a piece of muslin, tying this to a stick of wood, so that by putting the stick across the mouth of a jug the substance is suspended at the top of the water that it contains. About a quart of water may be taken. If after a few hours the salt has all dissolved, a little more must be similarly treated, that the solution may be saturated.

3. FERROUS SULPHATE (*a saturated solution*). This solution will not keep in good condition for more than a day or two. Probably the most convenient way to make the half-ounce or so needed is to grind up a little of the salt with rather less than the required amount of water, seeing that a little of the ferrous sulphate remains undissolved.

The method is to soak the plate in the mercury solution until very nearly bleached through, then to wash well. The mercury solution held in the film will complete the bleaching during the first minute or two of the washing. If the bleaching is quite complete before the mercury solution is poured off, an unnecessarily large amount of the mercury salt enters the film, and the washing takes a longer time. After perhaps an hour's washing, measure just sufficient of the potassium oxalate solution to cover the plate and add to it one-sixth by measure of the ferrous sulphate solution, and apply to the plate. When the image is thoroughly blackened, as shown by looking at the back of the plate, wash as usual.

If hard water has been used, it is well to gently rub the surface of the film while it is under water with a pad of cotton wool held so that the nails cannot scratch the film. This will detach the most of the calcium oxalate deposited from the hard water. If the plate, after drying, shows any deposit on its surface it may be safely neglected, as it will disappear when it is varnished. With soft water this production of oxalate of lime does not occur. If it should prove an annoyance, the lime may be removed from a gallon of water by adding to it a solution of a few grains of potassium oxalate, and allowing the deposit to settle. The purified water may be used for the two washings that immediately precede and follow the application of the ferrous oxalate. The amount of potassium oxalate required may be from 20 to 30 grains or more, according to the hardness of the water.

The mercuric chloride solution should have nothing added to it except the acid mentioned. Ammonium chloride is unnecessary and not advisable. In the absence of mercuric chloride it has a specific effect upon the bleached image which is quite different from that of ferrous oxalate, and it is quite unnecessary to run this risk.

No acid should be added to either the potassium oxalate solution or the ferrous sulphate solution ; it is not required, and its effect is to slow the action of the ferrous oxalate. The ferrous oxalate should be prepared as stated, and not diluted with water. Nor should any of the potassium oxalate solution be replaced by water, as that would slow the action and might render the precipitation of the yellow deposit of ferrous oxalate dangerously possible. The proportion of one to six, as recommended, gives a large excess of potassium oxalate, which ensures a clean action, and allows plenty of margin for errors of measurement. If the ferrous sulphate taken were increased by 50 per cent, the mixture would probably work satisfactorily, but as the amount of ferrous sulphate solution to be measured is generally small, it is well to have a large margin of safety. The addition of a bromide to the ferrous oxalate solution slows the action and offers no compensating advantage. The action of the ferrous oxalate in intensification is not comparable in this matter to its action in the development of an exposed plate. We want it to work quickly and thoroughly, there is no discrimination to be effected as between exposed and non-exposed silver bromide. In intensification the whole of the metallic salts present have to be reduced to the metallic state, and the more quickly this is done the better. The ferrous oxalate cannot possibly do too much, therefore all retarders are disadvantageous.

The ferrous oxalate solution may be used at once for as many negatives as it will serve for; but if only the necessary quantity is mixed, though it may suffice for a second plate, it is generally so slow in action on a third plate that it is preferable not to rely upon it.

A Reliable Silver Intensifier

BY A. J. JARMAN

It not infrequently happens, in professional studios as well as in the amateur's dark-room, that negatives developed during the cold season, or in developers at too low a temperature, are thin and unsatisfactory in printing density, especially when platinum or carbon printing is in view. The obvious remedy is intensification, but the average man's experience, usually based on the mercurial methods, causes him to hesitate because of uncertainty as to the result and doubt as to the permanency of the negative after intensification. These fears, unfortunately, are often well grounded as far as the mercurial processes are concerned. It is well understood among professional printers that rich platinum prints can hardly be obtained from negatives so intensified.

The intensifier here proposed is one in which the salts of silver replace the salts of mercury. In the writer's hands for many years past it has given uniformly good results, and the negatives so treated show no signs of deterioration. Care is needed in the preparation of the solutions, distilled water being used, and the negatives must be thoroughly clear of all traces of hypo before intensification is attempted.

Prepare the following solution: Nitrate of silver, 200 grains; distilled water, 8 ounces. Allow the silver nitrate to be completely dissolved, then add sulphocyanide of ammonia, 480 grains, shaking the solution as the last named is added to it. It will be seen that a precipitate (sulphocyanide of silver) is formed, but by constantly agitating the solution during the addition of the sulphocyanide of ammonia, the precipitate will gradually dissolve. Distilled water is now added to make the total bulk of the solution to 20 ounces. It will be noted that the precipitate reappears on this addition of water. A concentrated solution of hypo-soda must also be made and ready at hand. Add a little of this strong hypo solution to the silver solution, shaking the solution vigorously between each addition of hypo, until the precipitate has again dissolved and is no longer visible. This mixture should now be carefully filtered through absorbent cotton and marked *Stock Solution A.*

A second solution is now made up as follows: *Solution B.* Pyrogallic acid, 6 grains; sodium sulphite, 24 grains; potassium bromide, 4 grains; distilled water, 2 ounces.

The negative to be intensified is first thoroughly washed and the film carefully rubbed with absorbent cotton to remove all traces of greasiness or finger-marks. Too much stress cannot be laid upon this detail, for the moisture exuding from the fingers will affect those parts of the film they touch and stains will inevitably result.

The well-washed negative is now placed in a clean tray. Into a clean graduate is poured 1 fluidounce of *Stock Solution A;* 2 fluidounces *Solution B*, and 12 drops stronger ammonia water. Let these be well mixed, then pour over the plate with a sweeping motion as in development. Rock the tray gently, and watch for the desired degree of intensity. Gradually the negative will gain in density until it reaches the color and appearance of a perfectly developed plate.

Once the solutions are made ready the whole operation does not consume more than a few minutes, after which the plate is well washed and put aside to dry.

The above is simply a variant of Wellington's intensifier, first introduced in 1889, the most flexible as well as the most generally useful of all silver intensifiers. Because of its importance, we quote at length the clearest and best account of its preparation and use we have yet seen, given by Mr. Henry W. Bennett in *Photography*, May 14, 1904.—EDITOR.

The method about to be described fulfils every requirement of a perfect intensifier. It is simple, certain, thoroughly under control, and capable of imparting any degree of intensity desired—from a very slight strengthening, up to considerably more than can be given by any form of mercury. And, however far the operation is carried, the plate has the appearance of one that has simply been developed, excepting for the difference in strength.

Before intensification, a preliminary precaution is necessary. The film must be very thoroughly hardened in order to prevent this solution from softening it, and causing frilling, blistering, reticulation, and also to avoid an iridescent staining and deposit of silver on the surface of the film that may otherwise occasionally occur. For hardening the film, there is nothing to equal formalin, a good strength for the purpose being: Formalin, 1 part; water, 9 parts. The plate should be immersed for two or three minutes, and washed for a few minutes in several changes of water.

The negative may be intensified immediately after washing from the formalin bath, or dried first. The latter is preferable, when practicable; the hardening of the film is more thorough. In either case, intensification will proceed satisfactorily. There will be no tendency to staining or deposition of silver on the surface of the film other than that utilized in building up the image, and no tendency to blistering or reticulation.

A stock solution of silver should be kept from which the intensifier should be prepared when required: Silver nitrate, 480 grains; water (distilled), 10 ounces.

Distilled water is desirable for all stock solutions in photographic work; for those containing silver it is imperative.

To make five ounces of intensifier, one ounce of the silver solution should be taken; and ammonium sulphocyanide in crystals should be added until the precipitate first formed is just dissolved. Nearly two and a half times the weight of the silver salt will be required, or about a quarter of an ounce for the ounce of silver solution taken. On first adding sulphocyanide crystals, the silver will be precipitated in a dense white mass resembling curds and whey, the further addition changing the mixture to one similar to chalk and water. At this stage, sulphocyanide must be added more slowly and cautiously, and the solution stirred from time to time with a glass rod, until sufficient is added to make it as clear and as colorless as water. Although approximately a quarter of an ounce of sulphocyanide for each ounce of silver solution will be required to effect this change, the actual amount must be determined by clearing the solution in the manner described; sufficient must be added to produce this result, and no more. Sufficient distilled water must then be added to make the solution measure four and a half ounces, when a second precipitate will be formed, and the mixture again will resemble chalk and water. This precipitate must be dissolved by the addition of sodium hyposulphite. A strong solution of hypo is the most convenient form for making this addition, and it should be poured in cautiously, a little at a time, with frequent stirring. As in adding the sulphocyanide, sufficient must be used to make the solution absolutely clear, but no more. The amount of hypo required will be about two and a half times the weight of silver taken; but the clearing of the solution must be the actual test of the correct quantity.

Although this description may cause the operation to appear troublesome and tedious, it is not so in practice. The solution can be prepared in two or three minutes, and it is necessary to mix it as required, as it will not keep more than two or three days. The stock silver solution will keep indefinitely.

Quantities have been given for mixing about five ounces of intensifier; for any other quantity, care must be taken to follow the proportions given very carefully to ensure successful working. Whatever quantity of intensifier is required, the quantity of silver solution should be one-fifth; and, after the sulphocyanide is added, it should be diluted until it measures four and a half times the quantity of silver solution taken.

As this intensifier contains sodium hyposulphite, the very thorough washing to free the film from all traces of the fixing salt that is required for all other forms of silver intensification, to avoid staining, is not necessary.

A plate may be intensified after a comparatively short washing after fixing; but it is better, whenever possible, that the film should be properly washed in order to ensure reliable and uniform results.

To intensify, to each ounce of the silver solution are added: Pyro, 3 grains; potassium bromide, ½ grain; sodium carbonate, 24 grains. The pyro should be taken from the usual stock solution, with either sodium sulphite or potassium metabisulphite as the preservative. Sufficient sodium sulphite should be used to prevent undue discoloration, as in ordinary development. My usual plan is to keep a stock solution containing equal quantities of sodium carbonate and sodium sulphite, the pyro being preserved with half its weight of potassium metabisulphite. This adds twenty-four grains of sodium sulphite to the above solution, sufficient to ensure that the solution shall remain clear. Any other alkaline developer may be used instead of pyro and soda; but in any case a much larger quantity of each constituent should be added than for ordinary development.

If the plate has been dried, it is desirable that it should be soaked in water before intensification; it will facilitate the working considerably, and also allow a smaller quantity of solution to be used successfully.

The negative is redeveloped in this solution, and it will slowly gain in intensity. The dish must be rocked and the plate kept covered with solution, the treatment being identical with ordinary development, excepting that the operation may be conducted in full daylight. More sodium carbonate may be added if desired; but it is not desirable to increase the quantity beyond twelve times the amount of pyro used.

As the increase of density is very gradual, it is not always easy to judge from the accession of strength whether the solution is working satisfactorily. This may be gauged by its keeping clear or free from sediment, though it will discolor like a developer. It may also be estimated from the surface of the plate, which assumes a dull gray tint.

At a temperature of 65°, the action is completed in about twelve or fifteen minutes, the solution becoming discolored and having a tendency to stain the plate;

and, as the action on the negative ceases, to deposit silver on the dish. The discoloration that occurs during twelve or fifteen minutes' action is similar to the darkening of an ordinary developer; and, while the solution remains clear or free from muddiness, there should be no staining of the plate. A porcelain dish should be used for this intensifier.

On taking the plate from the solution, it should be slightly rinsed—not more than is necessary to wash off the adherent solution—and placed for a minute or two in a weak acid bath: Hydrochloric acid, 1 dram; water, 10 ounces. Then washed in several changes of water, and transferred to a clean fixing-bath of the usual strength for fixing negatives, in which it should remain for about ten minutes, then washed as usual, and dried. The fixing-bath may be made slightly alkaline with either soda or ammonia with advantage; so that, if there should be a slight trace of acid left in the film, it will be neutralized.

Standard Methods and Formulae

Mercuric Chloride

Make up a stock solution of mercuric chloride by powdering 1 ounce of mercuric chloride and dissolving it in 15 ounces of hot water. When the solution has cooled, there should be a deposit of white, feathery crystals at the bottom of the bottle. Pour off the clear liquid into a clean bottle and add 2 or 3 drops of hydrochloric acid per ounce of solution. As this stock solution is extremely poisonous, label plainly and handle with care; it will keep indefinitely and may be used repeatedly.

To intensify, the well-fixed and washed negative should be immersed in the mercury solution and gently rocked until the image is completely bleached or whitened through the film, as seen by examination at the back. It is then washed in running water for at least half an hour to completely eliminate all traces of mercuric chloride from the film. The success of the after-treatment depends on the thoroughness of this washing.

To reblacken the bleached image we have choice among several methods, differing in the amount of intensification given.

1. A dilute solution of ammonia prepared by adding 15 drops of stronger ammonia water ·880 per ounce of water. This gives vigorous intensification, but the action is uncertain, stains are liable to occur and the results are rarely permanent.

2. A 10 per cent solution of sodium sulphite. This gives permanent results, but the degree of intensification is slight and not proportionate throughout the scale of gradation in the negative. Practically it intensifies the stronger portions of the negative, while weakening the shadow detail and leaving the half-tones unchanged.

3. A 5 per cent solution of acetonesulphite gives proportionate intensification of the normal gradation of the negative and is slightly more energetic in its action than sodium sulphite.

4. Ferrous oxalate development, as set forth by Mr. Chapman Jones on another page—the best of all mercurial methods.

5. Schlippe's Salts, from 10 to 20 grains per ounce of water, freshly prepared.

6. Redevelopment with metol (Harris' formula): A: Metol, 5 grains; sodium sulphite (crystals), 45 grains; potass bromide, ¾ grain; water, 1 ounce. B. Sodium carbonate, 4½ grains; water, one ounce. Use 3 parts of A to 1 of B.

7. Eder's mercuric-ammonia-iodine process. Bleach as usual. Wash. Reblacken in water, 10 ounces; ammonia ·880, ½ ounce. Again wash. Further intensify in, Water 10 ounces; potassium iodide, ½ ounce.

8. Bleach as above and reblacken in a solution composed of: Water, 10 ounces; ammonium sulphide, 1 ounce. This is said to give the maximum intensification obtainable in one operation.

Mercuric Bromide

Powder 100 grains mercuric chloride and dissolve in 8 ounces of hot water; dissolve 100 grains mercuric bromide in 2 ounces of water, and mix the two solutions. Distilled water is preferable, and the mixed solution should be clear without deposit. Bleach the well-washed negative in this until it appears as a well-marked positive when viewed from the back; wash in running water for 10 or 15 minutes, and then immerse for 4 minutes each time in 3 baths of hydrochloric acid, 1 dram; water, 10 ounces; then again wash in running water.

Reblacken the bleached image in a 10 per cent solution of sodium sulphite, or: Sodium sulphite, 1 ounce; sodium carbonate, 1 ounce; water, 10 ounces; until thoroughly blackened. Wash for 30 to 60 minutes. According to Bennett, this method gives considerable intensification but is not uniform in its action throughout the scale. It intensifies most the denser portions of the negative and there is a slight reducing-action in the feeblest details. Hence it is most useful for over-exposed and under-developed negatives, or wherever contrast is lacking.

Gmeiner's variant of this method is given as follows: Bleach the well-washed negative in: Mercuric chloride, 1 dram; potassium bromide, 1 dram; water, 25 drams, at least sufficient water to thoroughly dissolve the salts. After bleaching, wash the plate for 15 minutes in running water, and darken in a solution made up in the subjoined proportions: Hydroquinone, ½ grain; sodium sulphite, 2 grains; potassium bromide, 1 grain; potassium carbonate, 1 grain; water to make 1 ounce. Pour this into a tray, and slide the negative quickly into it. When the bleached plate has somewhat darkened, pour off the solution into a graduate, and add an equal quantity of new developer to it, omitting the bromide. Take the plate from the tray, pour in the developer, immerse the negative, and rock the plate until density is acquired. When intensification is complete, the negative needs only to be washed and dried, after which the whole process may be repeated if desirable.

Mercuric Iodide

Lumière's original formula for this favorite intensifier read: Mercuric iodide, 4½ grains; sodium sulphite, 44 grains; water, 1 ounce. "Phos," in *Photography*, claims the following as better: Mercuric iodide, 10 grains; sodium sulphite, 200 grains; water, 10 ounces.

His instructions for preparing the mercuric iodide, when it cannot be bought, are to make a 2½ per cent solution of mercuric chloride and a 10 per cent solution of potassium iodide. These are then combined as follows: Mercuric chloride (2½ per cent solution), 2 ounces; potassium iodide (10 per cent solution), 5 drams; water to make 5 ounces.

The potassium iodide should be added a little at a time to the mercuric chloride solution, with stirring or shaking after each addition, till the red precipitate which first forms is redissolved, and the solution remains clear. No more should be added than is sufficient to effect this change. As each dram of the solution contains one grain of mercuric iodide, ten drams must be taken to make the ten ounces of intensifier as above.

The negative is immersed in the intensifier till it gains the required density. It should then be washed in several changes of water and placed in any alkaline developer for about the time required to develop a negative, say from seven to eight minutes. It is advisable to conduct the development by time, as frequently there is little or no visible change, and the stability of the intensified negative depends upon thorough development. No fixation is required, but it is essential that a thorough washing should be given.

Potassio-Cyanide of Silver

This is a mercurial method recommended by Carbutt as "very effective and the most permanent of methods." Prepare solutions as follows: I. Mercuric chloride, 120 grains; ammonium chloride, 120 grains; distilled water, 10 ounces. II. Ammonium chloride, 120 grains; water, 10 ounces. III. Distilled water, 6 ounces; cyanide of potassium (*poison*), 60 grains; distilled water, 2 ounces; nitrate of silver, 60 grains. Make up III in two parts as indicated, and pour the silver solution into the cyanide solution, with constant stirring. Mark the bottle plainly with the word *Poison*.

Wash the plate to be intensified at least half an hour. Then immerse it in a 5 per cent solution of alum (23 grains to the ounce), and again wash thoroughly to insure the complete elimination of all hypo from the film.

The least trace of yellowness in the film after intensifying will show that the washing was insufficient.

To intensify, flow sufficient of No. I over the plate to well cover it and allow the negative to whiten more or less completely, according to the effect desired. The longer this action continues, the greater will be the final intensity of the image. Now pour off the bleaching solution, rinse the plate and flow it with solution No. II, allowing this to act one minute only. Pour off and wash the plate, then flow with or immerse in No. III until blackening is completed. Wash thoroughly and dry. Solutions Nos. I and II should be thrown away. No. III may be used again. A negative made over-dense in this way can be reduced by immersing it in a weak fixing-bath, but the operation should be carefully watched, and the negative washed with plenty of water as soon as the reduction has sufficiently acted on the image.

A somewhat simpler formula is that advised by F. Edwards. Prepare the following solutions: I. Mercuric chloride, 50 grains; water, 5 ounces. II. Potassium bromide, 50 grains; water, 5 ounces. Mix these two solutions after preparation, and label the combination *Bleaching Solution*. Prepare III. Nitrate of silver, 50 grains; cyanide of potassium (pure), 50 grains; water, 5 ounces. Bleach the well-fixed and washed negative in the combined solution, and after a thorough washing darken to the desired intensity by immersion in III, after which the negative must again be washed.

With Copper

A copper intensifier, which is "made in Germany" and is recommended for flat negatives lacking contrast, is made up and used as follows: I. Sulphate of copper, 196 grains; hot water, 1 ounce. II. Potassium bromide, 196 grains; water, 1 ounce. Mix I and II; allow to cool, and pour off the green solution from the crystalline deposit. Bleach the negative in this liquid, wash for a short time, and blacken in a 10 per cent solution of silver nitrate. The image so produced can be strengthened still further by developing it with an ordinary developer if its density is insufficient. Over-intensification can be corrected by immersing the negative in a dilute bath of potassium cyanide, 2 grains; water, 1 ounce.

Ferricyanide and Uranium With many workers who do not care for the use of mercurial methods, the ferricyanide and uranium method is found to give equally good results. Negatives intensified in this way have a red color, which is deceptive as far as printing opacity is concerned, and considerable judgment is required to avoid over-intensification. Dr. Eder advises the subjoined formulæ: I. Uranium nitrate, 15 grains; water, 4 ounces. II. Ferricyanide of potassium, 15 grains; water, 4 ounces. Distilled water should, if possible, be used in the preparation of these solutions. For use, take 1½ ounces each of No. I and No. II, mix, and add ½ ounce of glacial acetic acid. The well-washed negative is immersed in this, with occasional rocking of the tray until the desired intensity is secured. After intensification, the plate should be washed for ten or fifteen minutes. Prolonged washing will remove the intensification, and marking or streaks will follow if the water is permitted to fall on the plate with force. If the washing is continued until the greasiness of the surface of the film, resulting from the use of the acid, is removed, this will be sufficient. Over-intensification can be reduced by immersing the negative in a weak solution of ammonium carbonate or ammonia water, which discharges the color from the image. Advantage may be taken of this to use the method as a means of local intensification. Thus, the negative is first intensified completely, and the image reduced locally by appling a dilute ammonia solution (½ ounce ammonia water in 15 ounces of water) with a camel's-hair brush. In doing this the negative should be held so that the ammonia solution does not run over the spot being reduced, and the plate should be frequently immersed in a tray of water.

Wellington's Silver Method Dissolve silver nitrate, 50 grains; in water, 1 ounce; then add ammonium sulphocyanide, 120 grains. The precipitate first formed is redissolved.

Now make up the total bulk of the solution with water to 10 ounces — a white precipitate is thrown down. Add drop by drop a saturated solution of hypo, just enough to redissolve the precipitate. This forms the stock solution, which keeps indefinitely.

To intensify a negative take: Stock solution, 1 ounce; sodium sulphite, 12 grains; ammon. bromide, 2 grains; pyro, 3 grains; ammonia, ·880, 6 minims.

Immerse the negative, and rock the dish gently until sufficient density is gained. Observe the following points: This method does *not* necessitate the complete removal of the fixing hypo before it is applied. The degree of intensification is almost unlimited, and can be stopped at any desired stage. The intensification is by adding atoms of silver to silver as in wet collodion development, and the results are not liable therefore to subsequent change. Density increases somewhat on drying, so that this should be allowed for.

Reduction Methods

Compared with intensification, the reduction of negatives is a comparatively simple matter, attended with little or no uncertainty. Despite the newer methods hereinafter detailed, the favorite method in use is that introduced by Mr. Howard Farmer many years ago and generally identified with his name. It is a solution of hypo-soda mixed with a small quantity of potassium ferricyanide or *red* prussiate of potash. As daylight decomposes a solution of ferricyanide very quickly, the work of reduction should not be carried on in a strong light and, if kept in solution, the ferricyanide should be protected from the light.

Farmer's Reducer

The procedure is as follows: Dissolve 1 ounce of ferricyanide of potassium in 9 ounces of water, and make the solution up to 10 ounces, forming a 10 per cent solution. Label this Poison. The negative to be reduced should be immersed in water for an hour or so to ensure its being thoroughly and uniformly wetted. Now take enough fresh hypo fixing-bath for the purpose and add to it enough of the ferricyanide solution to make it a light straw-color. The negative to be reduced is immersed in this solution, when it will be seen to lose density. The tray should be rocked to ensure uniform action of the reducer, and the negative should be frequently examined, by looking through, to watch for the point of sufficient reduction. The rapidity of the reduction depends upon the quantity of ferricyanide added to the hypo solution. The plate should preferably be removed from the solution before the reduction is as full as was intended, and immediately well washed in plenty of water. If the solution should seem exhausted, or refuse to continue the reduction, the addition of a little more ferricyanide will facilitate matters.

This method of reduction lends itself admirably to local treatment, such as the reduction of high-lights or other peculiarly dense portions of the negative. This property makes it useful for negatives which have been under-exposed and developed with harsh contrasts. A small quantity of the hypo and ferricyanide solution is put into a graduate or cup; the plate to be locally reduced is immersed in a plain hypo bath (1 to 4) for a few minutes, and then lifted until the over-dense portion is above the solution. The mixture of hypo and ferricyanide is now applied with a small brush where reduction is needed, and after a moment or two the plate is slid back into the hypo solution. This procedure may be repeated as often as is necessary, so long as the reducer is not too strong in ferricyanide and the plate is not kept out of the hypo solution for too long a time.

The Farmer reducer attacks the shadow details more energetically than the high-lights, so that its tendency is to increase the apparent contrasts of the negative. Opposed to this we have the ammonium persulphate reducer, which acts more strongly on the high-lights than on the weaker details, thus softening the contrasts.

Ammonium Persulphate

This reducer, introduced by Lumière, has been somewhat overpraised but is undoubtedly useful where the negative has abnormal contrasts, as in flashlight work, interiors, etc. A 2½ per cent solution is that most generally used, but I generally prefer to mix my working solution as needed by dissolving 10 grains ammonium persulphate per ounce of water required for the negative. It is advisable to stop the action of the reducer before the whole amount of reduction desired is reached, as its action seems to continue in the sulphite solution, this giving a flat and lifeless negative. The negative, after being reduced in the ammonium persulphite solution, is at once rinsed and immersed in a bath composed of sodium sulphite 10 grains, water 1 ounce, for 5 minutes and then well washed.

Ceric Sulphate The action of this reducer is similar to that of Farmer, but it does not stain and it keeps indefinitely. It is prepared as follows: Sulphuric acid, 2 minims; ceric sulphate, 44 grains; water, 1 ounce. It is desirable, in making up this formula, to add the sulphuric acid, a little at a time, to about one-fifth of the water, then dissolve the ceric sulphate in this acid solution and add the remainder of the water.

This practically forms a 10 per cent solution. For use 1 part of the 10 per cent solution is diluted with 9 parts of water. For very dense negatives a stronger solution may be used. When sufficiently reduced, the plate should be well washed.

Potassium Permanganate This salt was introduced by Namias in 1899, but does not seem to have justified his claims for it. Bennett advises the following modification of the original formula as given by Namias: Prepare a stock solution containing 10 grains of potassium permanganate in 10 ounces of water. For use dilute by adding 4 parts of water to 1 part of the stock solution. Immerse the negative in this dilute solution for 1 minute, wash in several changes of water, and then transfer to a 10 per cent solution of hyposulphite of soda for 4 minutes, after which well wash in running water.

If a yellow stain results from the permanganate bath, this can be removed by immersing the negative, after the hypo bath, in a weak acid bath—10 to 20 minims hydrochloric acid in 5 ounces of water. Distilled water is advised for the permanganate solution for the avoiding of stains.

Copper Reducer A simple and efficient reducer, advised by Shoemaker, is made up as follows: Sulphate of copper, 100 grains; bromide of potassium, 60 grains; water, 4 ounces. To use: immerse the plate in water and lightly rub the film until all signs of greasiness are removed. Pour a sufficient quantity of the copper solution into a tray and immerse the negative, examining it frequently to note the progress of reduction. For slight general reduction, a brief immersion in the solution will suffice. After the plate is sufficiently reduced, wash well and place in an ordinary hypo fixing-bath until the color is removed. Local reduction is easily managed by applying the reducer locally with a wad of cotton, rubbing the portion to be reduced with a gentle circular motion, after which again immerse the plate in the fixing solution for a few minutes, and wash as usual.

Ferrichloride Method

Another efficient reducer is ferri-chloride, 1 dram; hydrochloric acid, 2 drams; water to make 10 ounces. The negative to be reduced is well washed after fixing, and immersed in the above for a minute or so. On taking the negative out from this solution, no action will be apparent, but, on transferring it to a freshly mixed hypo-bath, reduction will take place very quickly, and the operation should be carefully watched, being stopped a little short of completion.

Notes and Comment

The Second American Salon. The pictures illustrating this issue of THE PHOTO-MINIATURE are selected examples from the prints accepted for the Second American Salon. Doubtless they will interest our readers as showing the quality of the exhibition and the high standard set by the Art Jury for this year's exhibits. The exhibition will make an extended tour of the principal cities, opening at Providence in December and closing at New York next May, so that many readers will be able to see the originals for themselves.

About 1,800 prints in all were sent in from the various local juries and collection centers, including 100 from Great Britain (sent by H. Snowden Ward) and a similar collection from Italy (sent by Alfred Ornando, Genoa). After the preliminary judging, about 550 remained for the criticism of the Art Jury, and of these less than 200 prints finally won acceptance for exhibition. Broadly speaking, the quality of the accepted work was a very distinct advance on that exhibited at last year's exhibition.

The grand prize of $100 awarded by the Federation for the best picture accepted was given to Mrs. A. G. Barton, Birmingham, England, for a picture of a mother and child.

The *Country Calendar* $50 prize for the best American landscape was awarded to James E. Underhill, of Brooklyn, N. Y.

The *Landmarks* $50 prize for the best historical landmark went to George T. Powers, Chicago, for his print of the Niagara Falls.

The first honorable mention in the Federation prize class fell to Guido Rey, of Turin, Italy; the second to Alfredo Ornando, of Genoa, Italy, and the third to W. Clayden, Plymouth, England.

Simple honorable mention was given to Louis Fleckenstein, of Faribault, Minn., and Fred H. Pratt, Worcester, Mass.

In originality, technique and size, the foreign work seemed to surpass the American work; but our hurried survey was made under difficulties, and we must return to the exhibition in a later and more complete review.

❧

The American Annual of Photography for 1906 has made its appearance and, as usual, offers a rich feast of pictures and timely information. Year-books are all very much alike, but this new volume of the American Annual certainly renews one's interest by the many attractive features gathered within its covers. The frontispiece is a superb example of Sepia Velox, the exquisite carbon-like tone being obtained by redevelopment. Among the 300 or more illustrations the photographer will find an unusual range of portraiture, this being a special feature of the Annual. The special printing of the full-page illustrations in tint is another point which places the 1906 volume well ahead of its predecessors and rivals. Among the illustrated papers, that by Dr. Detlefsen on "Cameo Relief Printing," with a relief portrait of the veteran Dr. John Nicol, will attract attention to this method of portraiture, which deserves a wider popularity. Another useful paper is that entitled "The Compass as a Time Saver," by I. W. Blake. Daisy Wilson Adams contributes a charming account of her pleasures with the hand-camera in an old-fashioned garden; Curtis Bell sums up "The First American Salon"; W. I. Lincoln Adams writes of "The Value of Snapshots"; F. Dundas Todd furnishes "A Plain Roast," and so on through a remarkably well-chosen series of helpful articles, most of them illustrated. *The American Annual of 1905* went out of print almost as soon as published. We shall be considerably surprised if the new volume does not disappear as quickly. It is a wonderful book for the money. Paper covers, 75 cents. Cloth edition, $1.25. Postage 20 cents extra. G. Gennert, Trade Agent, 24 East 13th street, New York.

A new extra-rapid plate, the Imperial, intended for instantaneous work on dull days or under difficult conditions, is being introduced from Great Britain by G. Gennert, New York. The Imperial has the reputation of being the best of all British plates, and the American photographer will do well to test its speed and quality. From the same house we have samples of the Imperial lantern plate, a splendid plate for its purpose, clear working, with considerable latitude and yielding beautiful transparencies with remarkable gradation qualities. The price is 55 cents per dozen, 3¼ x 4, and we secured 12 good slides from the sample box sent us.

❧

There is no doubt, if we may judge by our correspondence, but that carbon printing is steadily working its way among amateurs and professionals as the printing process *par excellence* when the best possible prints are required. We have often wondered why so few avail themselves of this simple printing process, considering its many advantages and the absolute permanency of its results. The choice of colors is extensive, the variety of papers and other supports for the finished prints is unequaled in any other process, and the paper can be adapted to all sorts of subjects and negatives. George Murphy Inc., Trade Agents, 57 East 9th street, New York.

❧

A question of unusual interest is brought forward in a letter recently addressed to our English exchanges by the famous lexicographer, Dr. J. A. H. Murray. It appears that in editing the "Oxford English Dictionary," now in course of publication, Dr. Murray finds himself unable to trace the origin or use of the words Photograph, Photography, Photographic earlier than the mention of them by Sir John Herschel in a paper read before the Royal Society, March 14, 1839. As Herschel then used the words as freely as we do today, without explanation or apology, Dr. Murray thinks that they must have been commonly known by previous use. He will therefore welcome the help of photographers in determining the source and first use of these words—

before March 14, 1839. The word Photographer, he has been told, appeared in the British Census of 1851, but he has not been able to locate it.

With regard to the words Photograph, Photography and Photographic, we know of no references previous to 1839, although J. K. Fisher, in Snelling's *Photographic Art Journal*, Vol. I, No. 1, New York, 1851, quotes from the contract between Niepce and Daguerre (1829) as reading as follows: "pour la copie photographique des gravures."

The word Photographer appears on the cover and title-page of "A Practical Treatise on Photography upon Paper and Glass, by Gustave LeGray, Painter and *Photographer*, Paris. Translated by Thomas Cousins, Lecturer on Natural Philosophy and Practical *Photographer*, London. T. & R. Williams, 1850."

In the article by Fisher in Snelling's *Journal* as mentioned above (January, 1851), the author says: "But if art is required to direct the labors of the *photographer*." Further in Snelling's *Journal* (N. Y., January, 1852), a translation of Claudet's "Researches in the Daguerreotype Process," says: "By means of this instrument (the photographometer) the *photographer* can make experiments," etc. In the same issue is an article credited "By A. Hesler, Practical Photographer."

That the word Photographer was not known or used much before 1850 is indirectly shown by the frequent reference to the "operator," "artist," "photographic artist," etc., in the photographic literature of the years 1839-48. Thus, in the English translation of the third French edition of Lerebour's "Treatise on Photography" (London, 1843, Longmans) M. de Valicour is translated as saying that "the object glass is undeniably the most important part of the *photographist's* apparatus."

Dr. Murray may be addressed at The Scriptorium, Oxford, England.

❧

In the "Annual Report of the Smithsonian Institute for 1904" is printed an interesting monograph entitled "The History of Some Discoveries of Photography," by Robert Hunt, revised by T. W. Smillie, of the United

States National Museum, from Chapters II and IV of *A Manual of Photography* by Robert Hunt, fourth edition. London and Glasgow, 1854. Octavo, pp. 329. The monograph is illustrated with many diagrams of ancient apparatus, copies of early photographs from originals in the National Museum and several of the illustrations which appeared in THE PHOTO-MINIATURE No. 60: *A History of Photography.*

⁂

We have received from the Eastman Kodak Company "The Modern Way of Picture Making," a revised and up-to-date edition of the official manual for the amateur using the Kodak. The book covers almost 200 pages, is profusely illustrated and contains all the matter in the earlier manual, entitled "Picture Making and Picture Taking," together with much new and interesting matter. The volume is indispensable to the Kodak worker and is unusually clear and explicit in its information. An example of this is seen in the chapter upon the Kodak Tank Developer, which is more fully explained and illustrated here than in any previous publication. Price $1, from all Kodak dealers.

⁂

The Metropolitan Camera Club, of 100 West 101st street, asks us to advise that the Club's fine portrait lens has been stolen from the Club rooms, and they will be grateful for any information regarding it if seen by any reader. The lens is an 18-inch Unar, No. 681980, size No, 10, made by Bausch & Lomb Optical Company. There have been only two lenses of this type and size made, so that its recovery should not be a difficult matter.

⁂

Burke & James, of Chicago and New York, advise us that they have purchased the good-will, trade-marks, patents and factory, with the tools and machinery, of James H. Smith & Company, of Chicago, and will resume the manufacture of the popular specialties formerly made by that firm. The addition of this well-known line of specialties to the staples and specialties already controlled by Messrs. Burke & James will give this house an unrivaled facility for the supply of articles needed in professional and amateur work.

⁂

The Brooklyn (N. Y.) Institute of Arts and Sciences, Department of Photography, announces a series of five special exhibitions for 1905-6. These exhibitions will be given in the Department Rooms at 201 Montague street, and will be in addition to the regular annual exhibition which is held in the Art Association Rooms. The exhibit from November 14 to 18, inclusive, will be a representative exhibition, to which each member is requested to send four pictures; the second show, from December 5 to 19, will consist of enlargements on bromide papers; the third, from January 9 to 13, 1906, of prints in gum bichromate; the fourth and fifth, from February 6 to 10 and March 6 to 10, will be invitation exhibitions of work by prominent photographers. A prize will be awarded for the best picture shown at the first three exhibitions.

⁂

The work of the Institute of Historical Research at Washington, D. C., briefly noted at the foot of page 670 of our September issue, is warmly commended in a recent letter from Mr. Melvil Dewey, the Director of the State Library at Albany, N. Y. The purpose of the Institute of Historical Research, as already noted, is to establish a photographic library at Washington for the supplying to libraries, schools, authors and others interested, permanent photographs of historical buildings, scenes, etc., for the illustration of lectures, books, educational courses and the like. This remarkable work, which is under the direction of the Rev. Henry Mason Baum, deserves the interest and support of all serious photographers. Particulars can be had from Dr. Baum, addressed at 304 A street, S. E., Washington, D. C.

⁂

The Society of Photography at Marseilles, France, announces the Fourth International Salon under the auspices of the National Union of Photographic Societies of France, to be held at Marseilles, February 3 to 25, 1906. Entries must be made before the 31st of December. Particulars can be had from the Secretaire General de la Société De Photographie, de Marseille, 11 Rue de la Grande Armeé.

❧

A remarkable invention is announced in the Cleveland (Ohio) *Plain Dealer*, dated November 5. The invention covers an automatic machine that will take positive pictures without the aid of intermediate negatives. We quote a paragraph from the newspaper account: "This new process cuts out the necessity of making or handling a negative and making a true positive picture in one operation. It provides the vehicle by making a photograph by direct exposure through the back of the film and making the image apparent in all its detail by reflected light on its face side. The material upon which the picture is to be taken is exposed with the back to the lens and developed in the ordinary way with specially adapted solutions. This gives the non-reversed positive. At this point of the manipulation all the affected and developed portions are then dissolved and the remaining portions toned to any desirable color by specially prepared solutions. This can all be done in a few minutes, and when this operation has been performed, the image has at once appeared upon the surface, non-reversed, with the high-lights of the picture standing out in relief upon a reflecting surface, the film containing a thin stratum of agent, which has been rendered sufficiently white in the meantime for the high-lights of the picture." The inventor, Mr. G. N. Pifer, has promised to send us full particulars and a sample print at an early date. Of these we will advise our readers in a later issue.

❧

Photographers interested in the color-toning of bromide prints, transparencies and lantern-slides, or the intensification of negatives, should write the Lumiere N. A. Company for the circular describing the Lumiere Chromogenes. These are powdered salts, made up by simply dissolving the salts in water, and giving sepia, red, blue-green or blue, violet, brown or red tones according to the particular salt used. For the intensification of negatives the uranium and copper chromogenes are used in the manner usual with intensifiers. Another interesting specialty of the Lumiere N. A. Company is Lumiere Formosulphite, a product which claims to replace both preservative and alkali in the preparation of alkaline developers. Full particulars are given in the circular, which may be had on application from the company at 11 West 27th street, New York.

❧

We have received from the publishing house of Wilhelm Knapp, Halle a/s, Germany, Eder's *Jahrbuch fur Photographie und Reproduktionstechnik fur das Jahr 1905*, nineteenth year. Price in Germany, 8 marks. This old favorite among continental yearbooks comprises, as usual, a detailed account of the progress of photography during the year, together with a number of practical articles upon many branches of photography by prominent authorities. The volume is illustrated, as in past years, with a collection of prints by various mechanical processes, some of which are in color. For readers of German the book is indispensable as a handbook, thoroughly covering what has been done in photography during the year.

❧

We record with sincere regret the death of W. H. Walmsley, the veteran optician, photographer and photomicrographist, who died suddenly at his home in Philadelphia on October 22, in his 75th year. For nearly forty years Mr. Walmsley was recognized as an authority in microscopical and photographic work. In the early years of the firm of James W. Queen & Co., of Philadelphia, he was an active member of that firm. Later he associated himself with the house of R. & J. Beck, of London, and built up an extensive demand for that firm's product in the United States. He afterwards organized the firm of W. H. Walmsley & Co., and conducted a general optical and photographic supply business on a large scale. In later years he was associated with Prof. John MacFarland in the Biology Department of the University of Pennsylvania.

Mr. Walmsley was a frequent contributor to various scientific journals, as well as to the photographic yearbooks. He was also the author of the *A B C of Photo-Micrography*, published a year or two ago, the only American work on this subject at present available. He was the founder of the American Microscopical Society and a member of the Royal Microscopical Society of London. An indefatigable worker in his speciality, he was always ready to advise and counsel those who applied for his help. His death will be mourned by a host of friends and correspondents here and abroad. Mr. Walmsley left a wife and several children. His nephew, Mr. J. M. Walmsley, president of the Century Camera Co. of Rochester, New York, is a well-known figure in the photographic trade.

⁂

A handy printing gauge for platinotype and carbon workers has been introduced by G. Gennert, of New York and Chicago. This gauge consists of a nickel-plated brass form enclosing a negative of twelve graded densities. In use it is fixed to the front of the printing-frame with a strip of printing-out paper in the gauge behind the graded negative. By its use one may determine the correct exposure required when printing in carbon or platinotype, thus obtaining a figure which gives the correct exposure for all carbon or platinotype prints made thereafter from the same negative. The price of the gauge is 30 cents.

Books and Prints

Photograms of the Year 1905. A pictorial and literary record of the year's work in picture-making by photography, compiled by the staff of *The Photogram*, London. 176 pp. 6½ x 9½ in., 152 illustrations. Paper covers, $1. Library edition, $1.50. New York, Tennant and Ward.

More interesting than last year's volume, and more than ever an incentive and an inspiration to every lover of photography. So may we frankly describe this work to those already familiar with the earlier issues of the series. To those unacquainted with the series we may say that *Photograms of the Year* is the only Annual offering a critical and comprehensive survey of the year's progress in pictorial photography. This it does by presenting articles (virtually reports) by competent writers dealing with the progress of the pictorial movement in different countries, the volume being profusely illustrated with engravings reproducing a broad selection from the best pictures of the year.

In the volume before us "Pictorial Photography in France" is dealt with by Robert Demachy; "The Progress of Pictorial Photography in Germany," by Fritz Loescher; "The Pictorial Effort in Denmark," by J. C. Stockholm; and "Spain," by M. M. Leon; a general retrospect of the year's tendencies and production, by the editors; a review of Australasian progress is given by A. J. Hill-Griffiths; "Pictorial Photography in Canada," by H. Mortimer Lamb; and a detailed description of the Royal Photographic Society's exhibition and the London Salon, by A. R. Carter.

The illustrations are, of course, the feature of prime interest. These are largely full-page engravings carefully printed, in which detail *Photograms of the Year* easily leads among the Annuals. The volume is carefully printed throughout on fine coated paper and is, in this respect, a further advance on previous issues.

❧

Von Hubl's Three-Color Photography. Translated by Henry O. Klein. 148 pages, 6 x 9 in., with two-color charts and monochrome representations of same. Price, $3.50.

Von Hubl's work, here translated for English readers, quickly took its place on publication as the standard text-book on three-color photography, embracing the purely photographic processes for lantern-slides and transparencies, and also three-color printing by the half-tone process. The translator is an expert in this branch of photography, and his translation is consequently both intelligible and thoroughly practical. It was undertaken with the express approval of Baron Von Hubl, who personally superintended the printing of the color supplements.

The volume begins with a brief statement of the three-color principle and its application. Part I deals with light and color in a theoretical sense, stating the fundamental principles in a clear and concise manner. Part II deals with the theory and practice of three-color printing, the sensitizing of plates and making of color-filters, the action of dyes. The making of three-color transparencies is also given considerable attention. The translator has made an appendix to bring the book right up to date in the important matter of direct three-color work.

Altogether, it is a book which we can thoroughly recommend to those interested in three-color reproduction, as dealing with the problem in an interesting and practical way.

❧

Leitfaden der Landschafts-Photographie. (Guide to Landscape Photography.) By Fritz Loescher. xii + 184 pages; 8½ x 6 inches; 27 illustrations from negatives by the author. Second edition, revised and enlarged. Berlin.

The popularity of this pleasantly written treatise by the art editor of the *Mittheilungen* is well attested by the need for this second edition within three years of its first appearance. The author has taken the opportunity to revise the work, although he found no need for any important modifications in his viewpoint, which is decidedly conservative, as against the influence of the modern landscape school. He cannot admit that the hundreds of workers since the advent of photography have been all wrong, even if a recent French writer has said that "the height of their ambition was to get on top of some hill, expose with *f*/64, on as many square miles of territory as possible, and print from the whole negative up to the edges."

Of course, the majority of workers will sympathize with this desire for clean lens work, and that may account for the warm reception given to the book, which advocates nothing revolutionary, and is a recapitulation in readable form of what has been said before by dozens of writers, rounded into unity by the practical experience of one man.

The illustrations are chosen from the author's own work, as he explains, not as masterpieces, but because he feels freer in criticizing them than if they were the productions of others.

⁂

Photo-Mechanical Processes. A Practical Guide to the Production of Letterpress Blocks in Line and Half-tone; Photo-lithography in Line and Tone; Collotype and Photo-gravure. By W. T. Wilkinson. Third edition, revised to date and rewritten. 216 pp.; illustrated; 5 x 7½. London, 1905. New York: Tennant & Ward, Price, $2.

Wilkinson's *Photo-Mechanical Processes* has long been regarded in Great Britain as a standard text-book on its subjects, and includes many methods not dealt with in other handbooks on engraving processes, i. e., collotype and photogravure. The author is a teacher of reproduction methods and guarantees the formulæ given to be successful in practical use.

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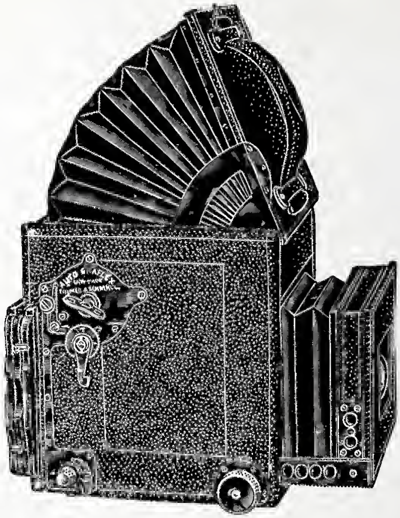

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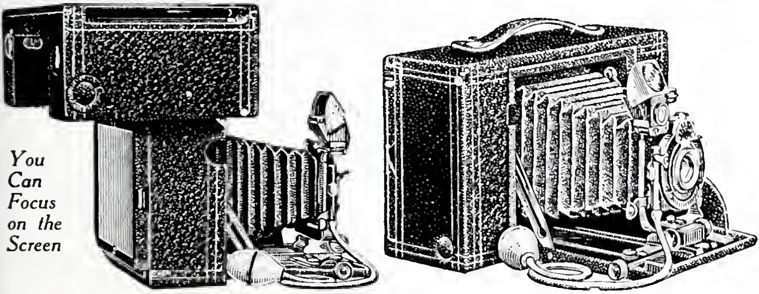

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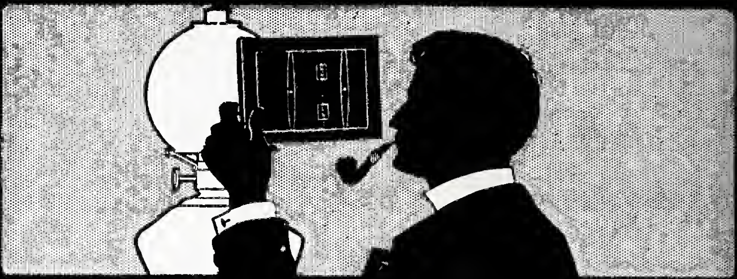

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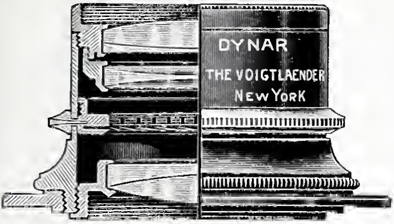

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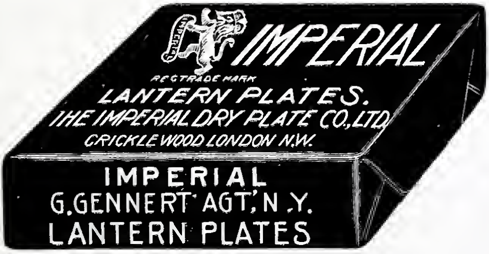

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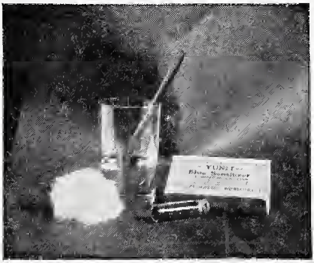

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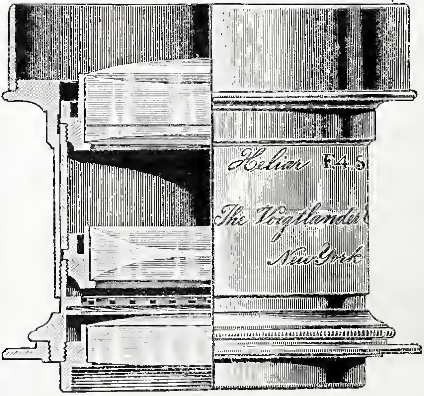

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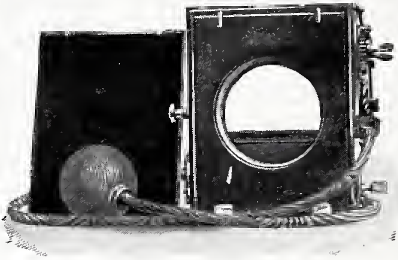

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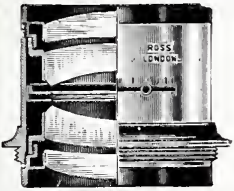

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*3. Hand-Camera Work
4. Photography Outdoors
5. Stereoscopic Photography
*6. Orthochromatic Photography
7. Platinotype Processes
*8. Photography at Home
9. Lantern Slides
*10. The "Blue Print," etc.
*11. Developers and Development
12. Retouching Negatives and Prints
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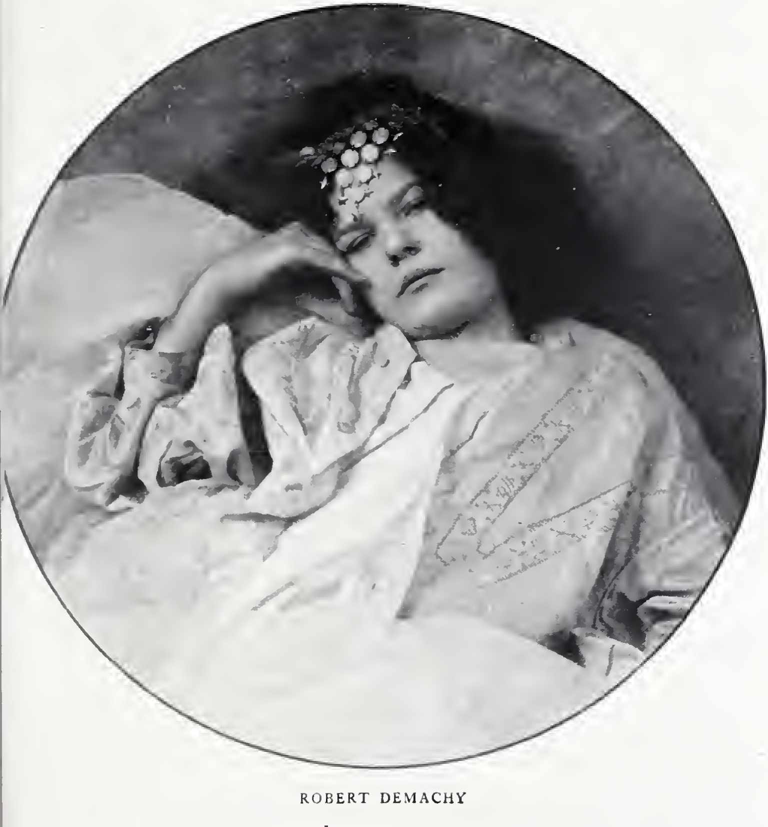

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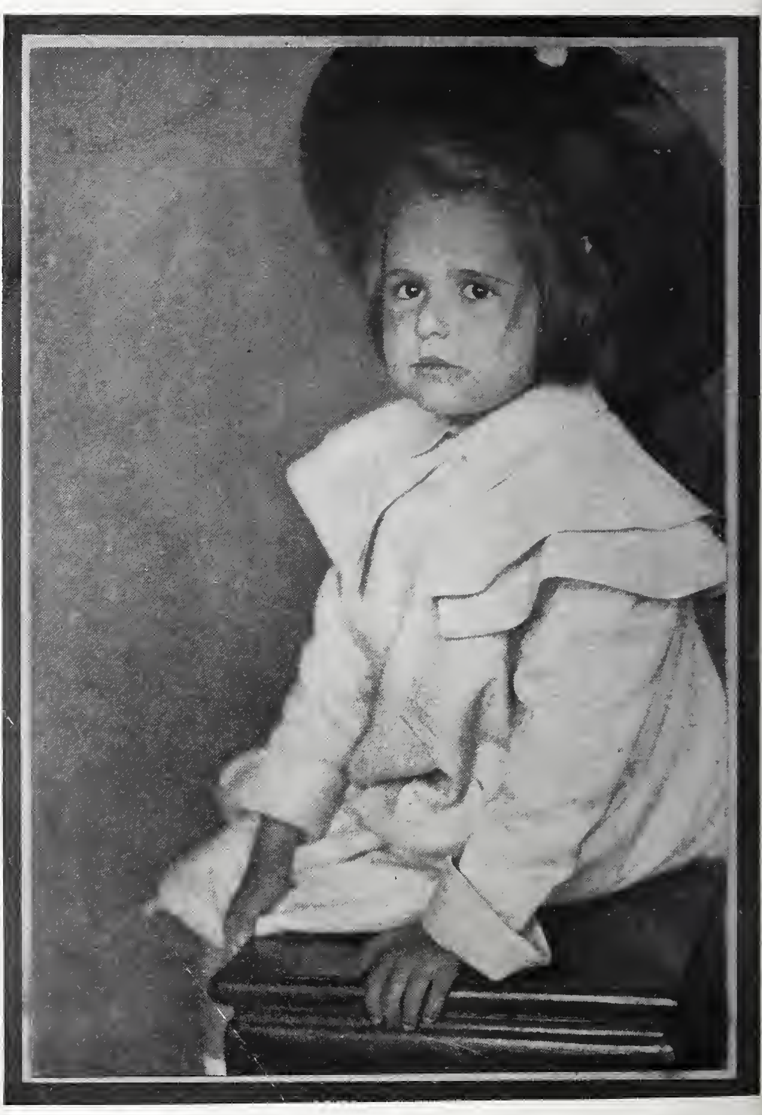
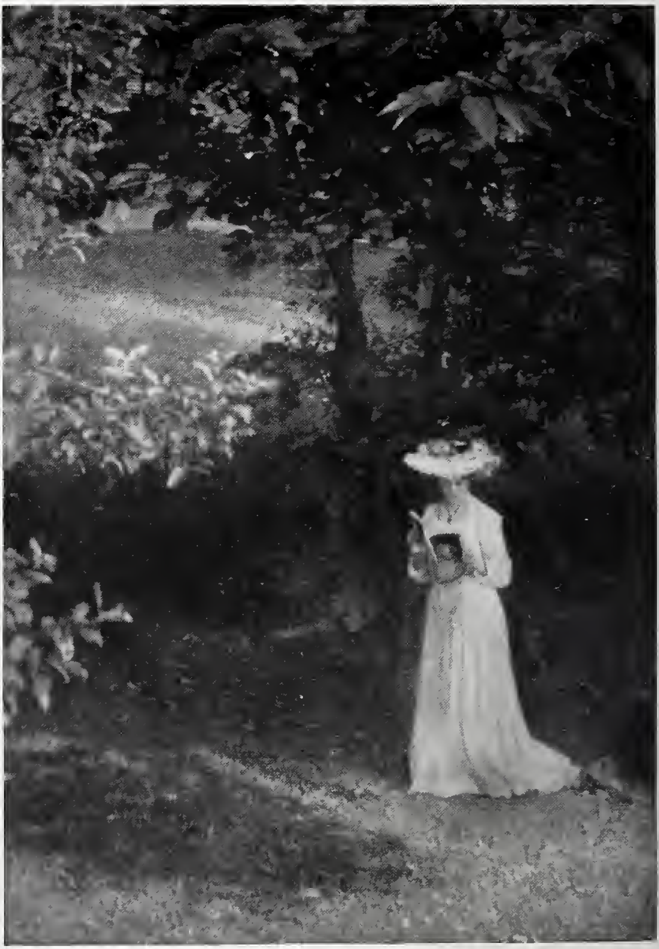


CHILD PORTRAIT: BLANCHE CUMMING

A WINTER'S TALE: FRED RADFORD



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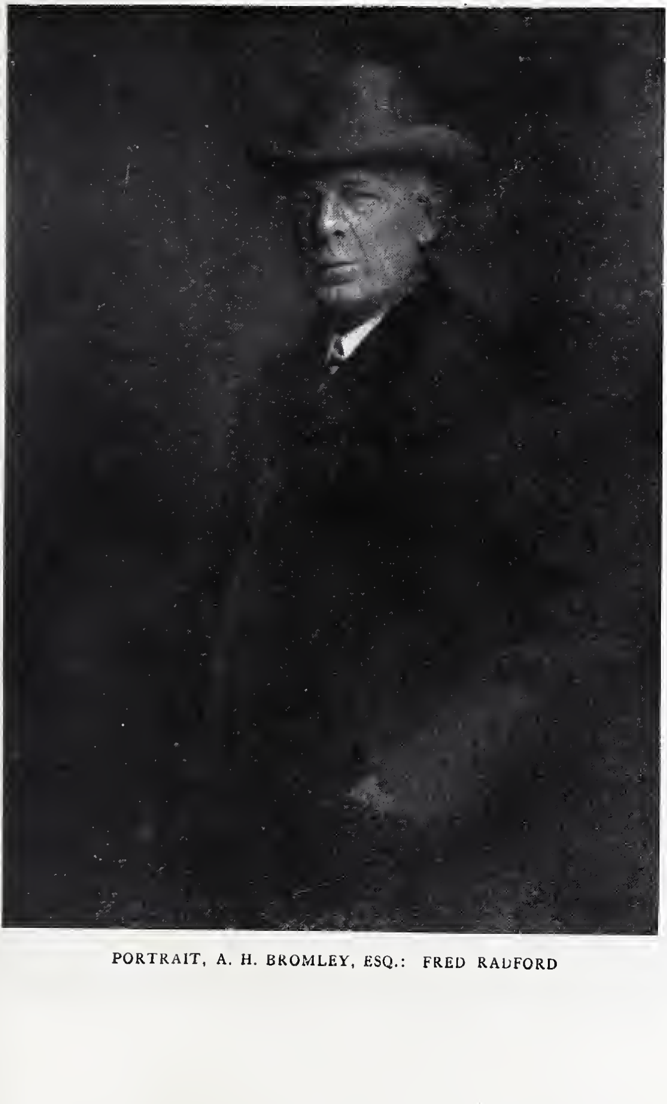
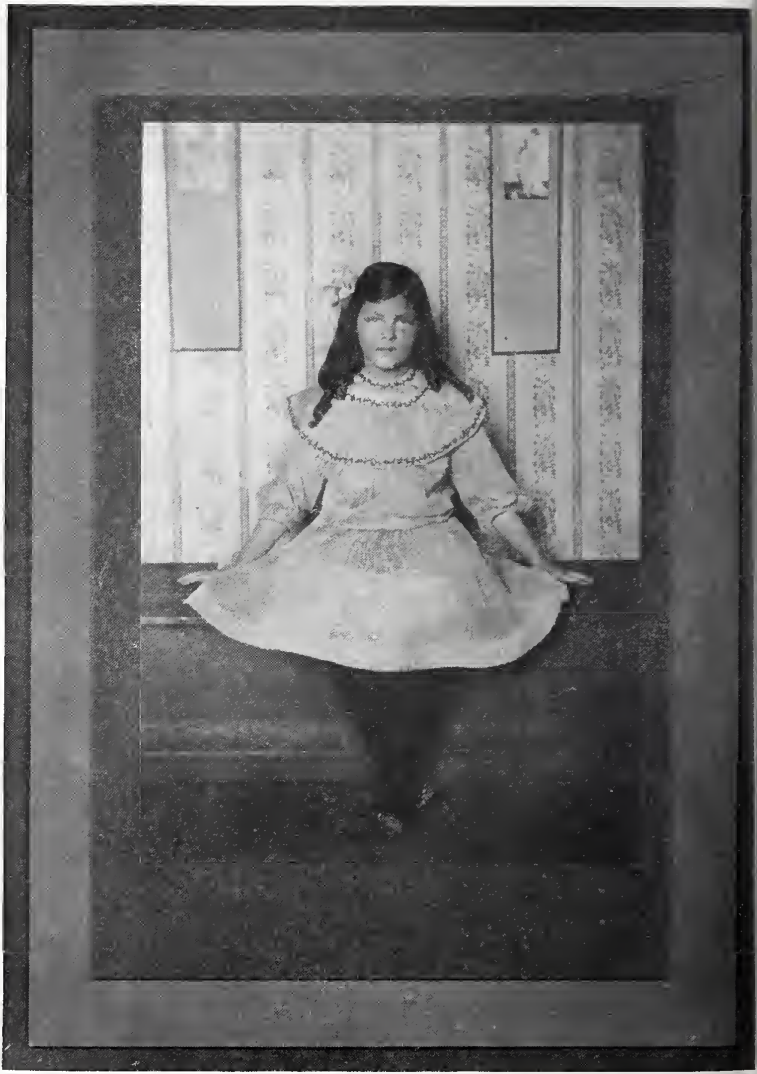
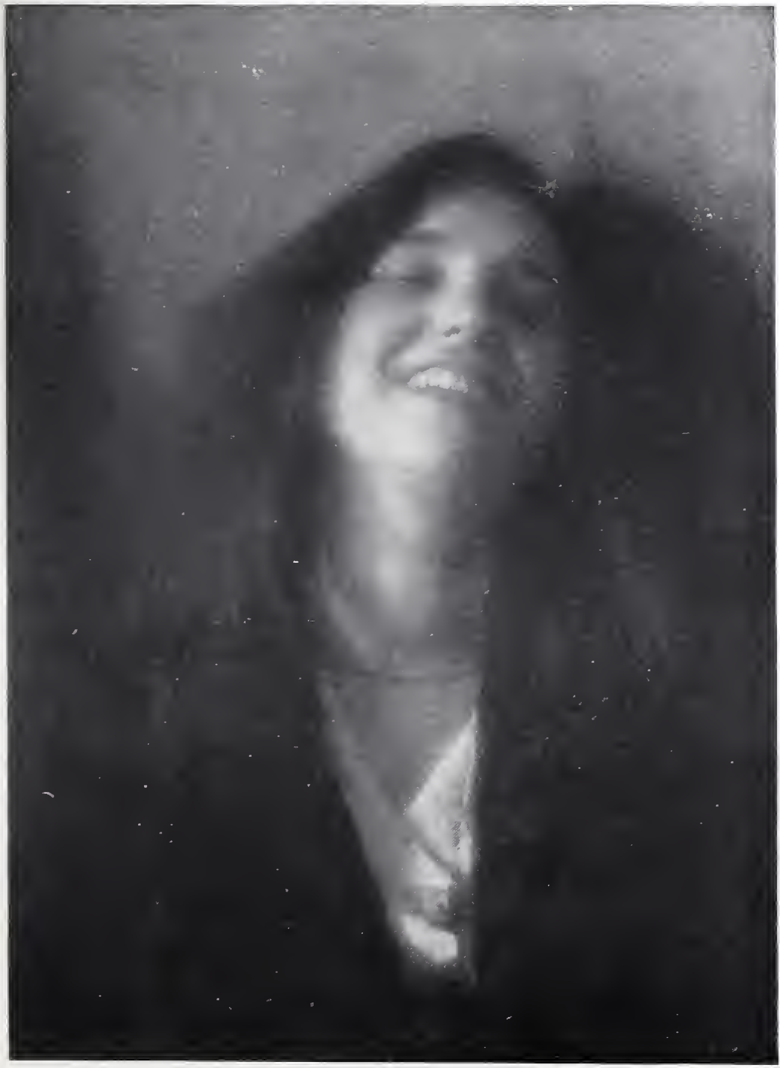


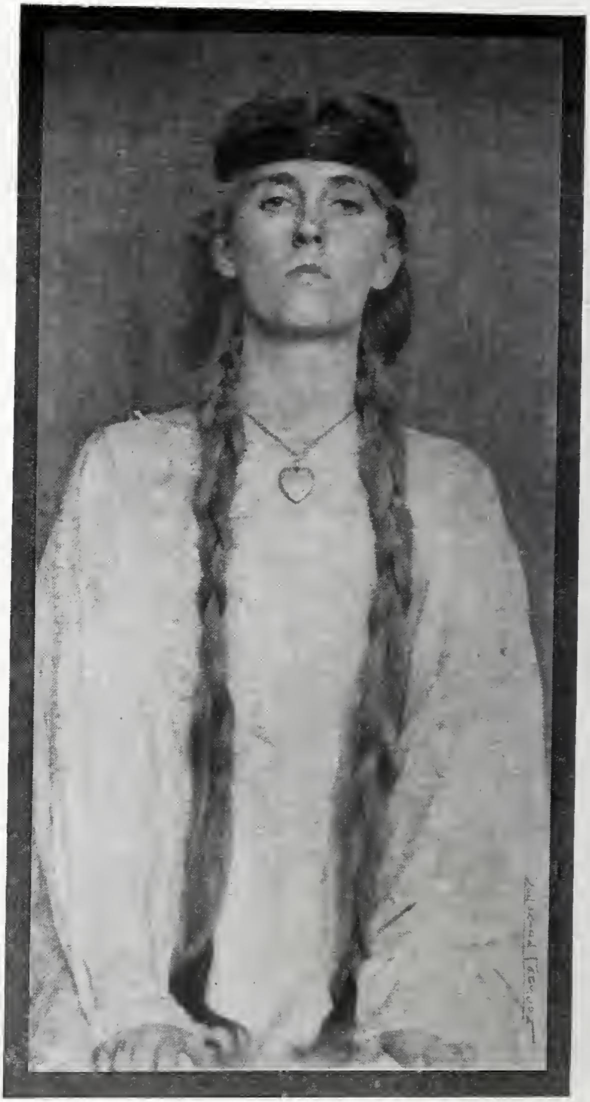
PORTRAIT, A. H. BROMLEY, ESQ.: FRED RADFORD



DOROTHY: BLANCHE CUMMING



MIRTH: MRS. J. E. BENNETT

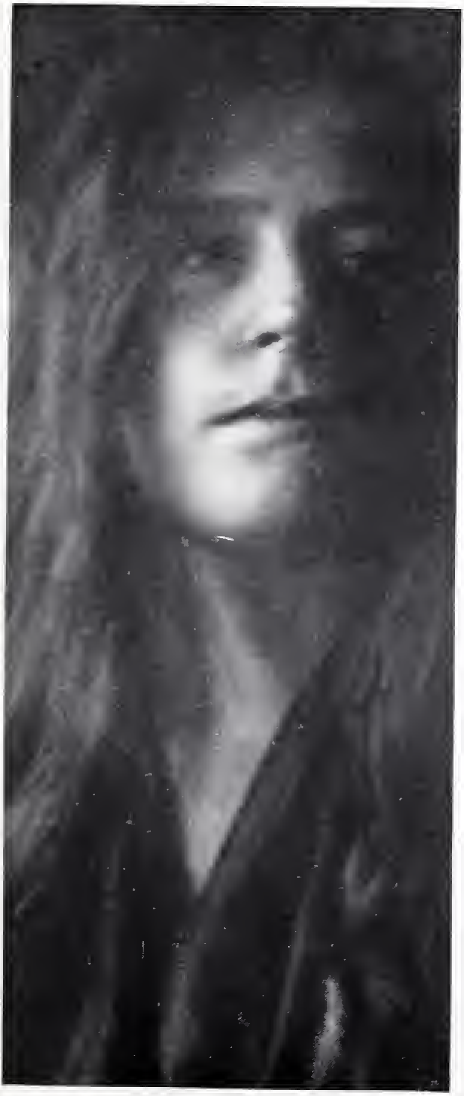


THE SPHINX: ADELAIDE HANSCOM

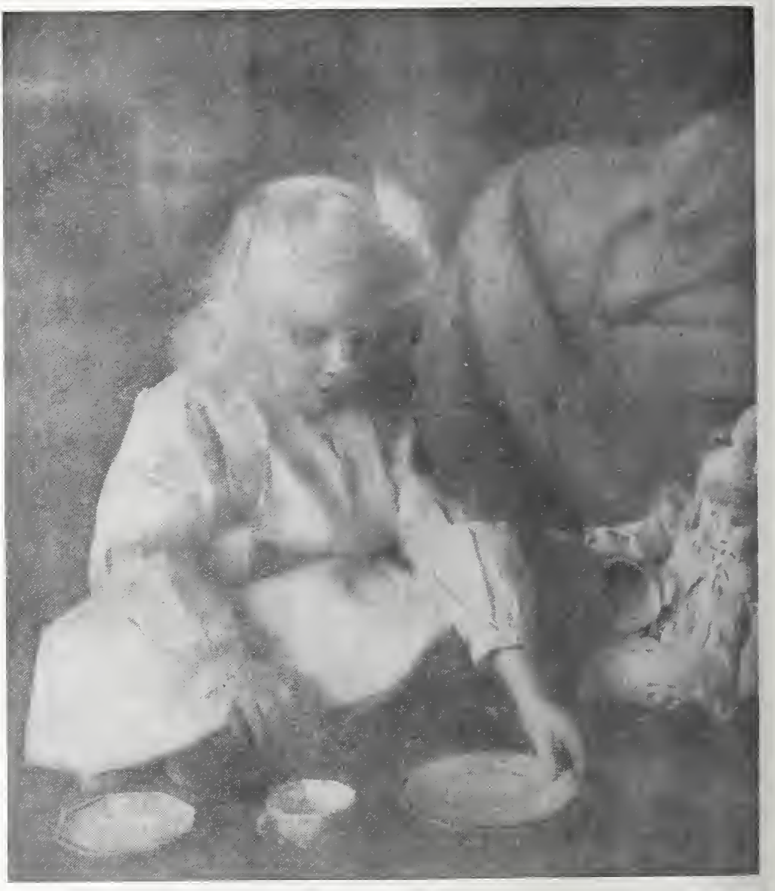
THE OLD MOTHER: BLANCHE CUMMING

KAMERA: H. G. FRENCH

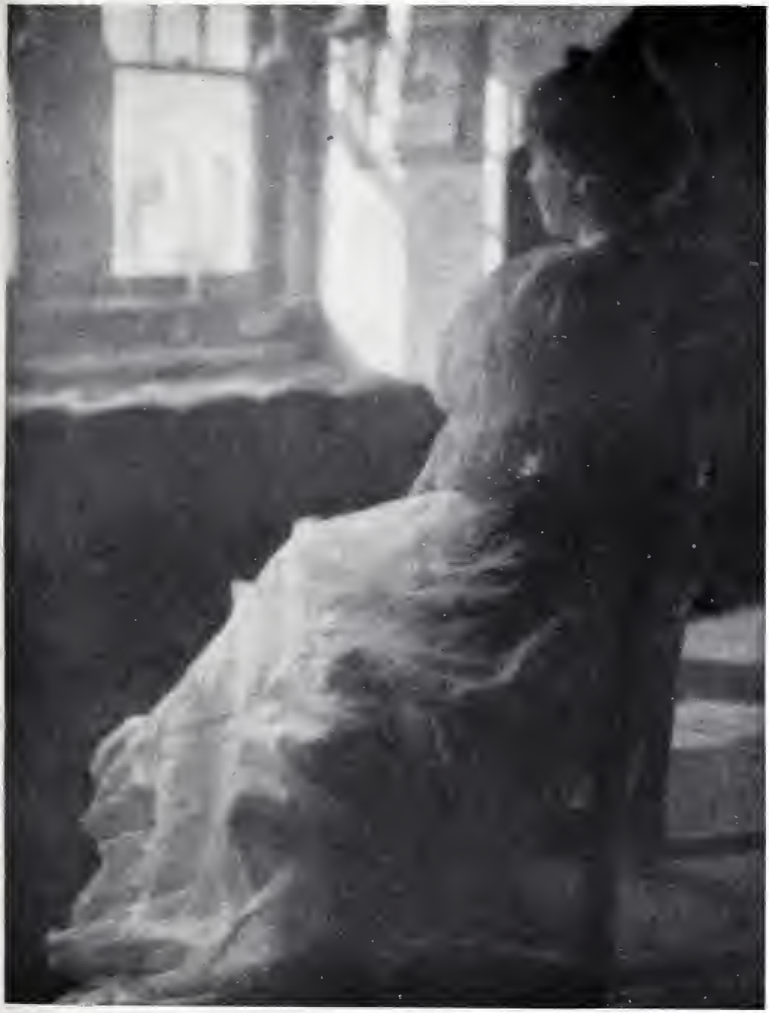
Print 3 x 6 inches; on dark gray mount



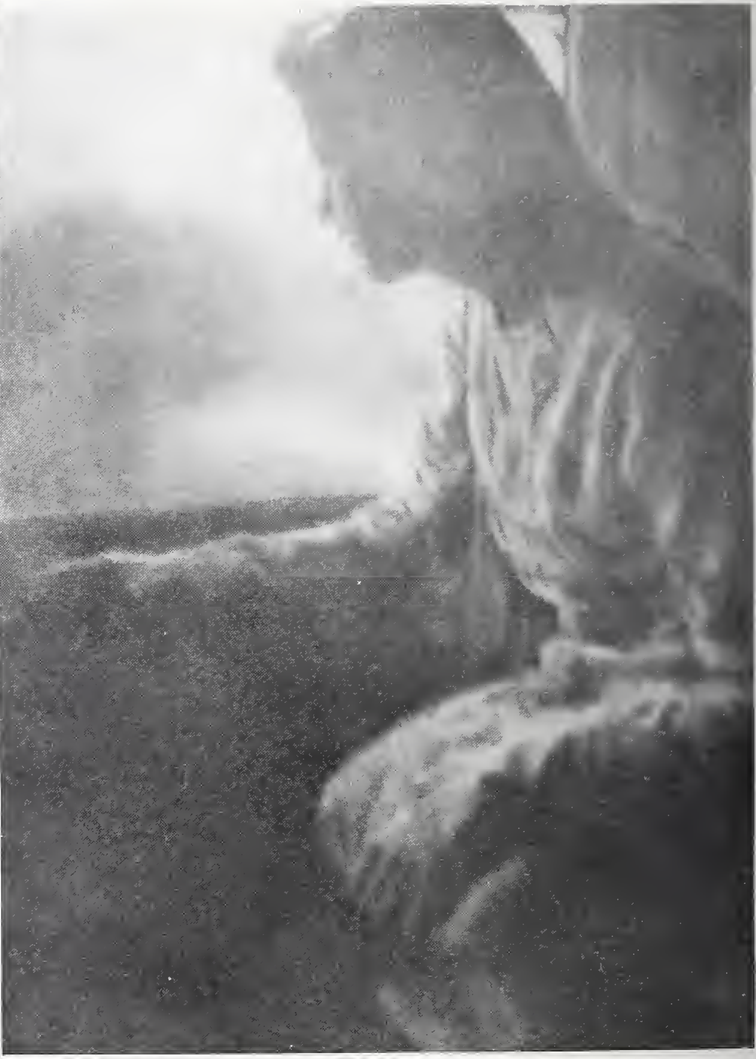
STUDY OF GIRL'S HEAD: H. G. FRENCH
Platinotype 3 x 8 inches; warm gray



CHILD AT PLAY: H. G. FRENCH
Platinotype 6 x 7; warm gray

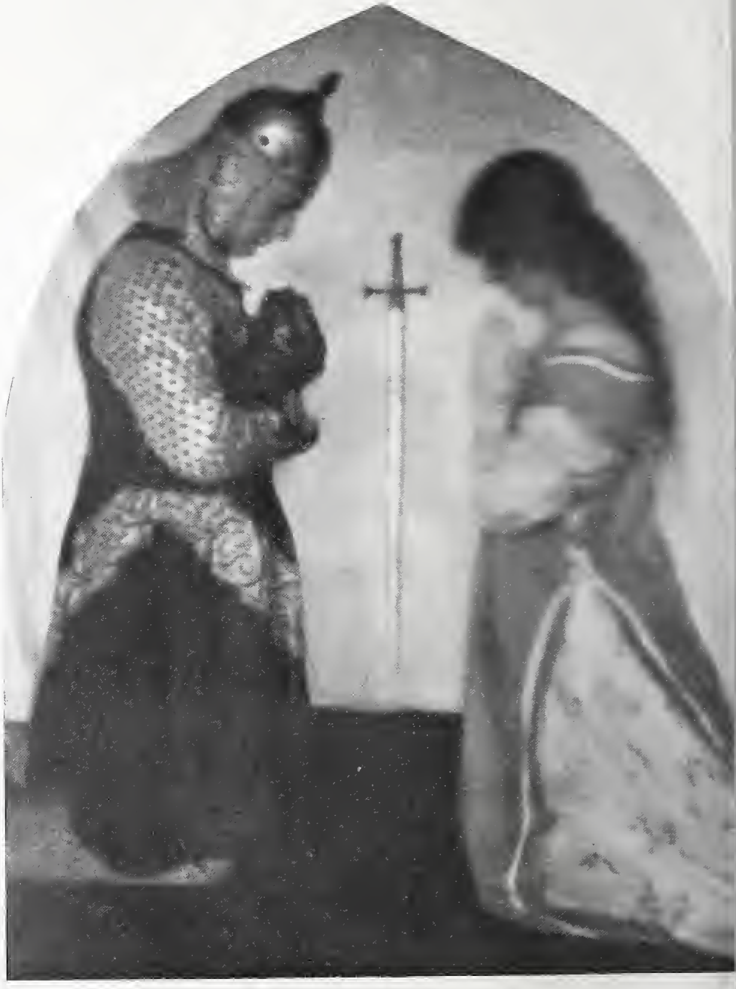


EVENING SUNLIGHT: H. G. FRENCH
Platinotype 5½ x 7; warm gray



AT THE WINDOW: H. G. FRENCH
Sepia platinotype 5½ x 7½ inches

STUDY OF KNEELING FIGURE: H. G. FRENCH
Print 4 x 6 inches; on sage-green mount



ILLUSTRATION; "THE HOLY GRAIL": H. G. FRENCH

Original sepia platinotype 6 x 8 inches

The Photo-Miniature

A Magazine of Photographic Information

EDITED BY JOHN A. TENNANT

Volume VII DECEMBER, 1905 Number 75

Bromide Printing and Enlarging

Bromide paper is simply photographic paper coated with gelatino-bromide of silver emulsion, similar to that which forms the sensitive surface of the dry plate or roll film, but very much less rapid, i. e., less sensitive to the action of light. Hence, although bromide paper cannot be manipulated in gaslight or weak daylight as papers of the Velox class are, yet it can be handled and used in more abundant light than we can employ with plates or films; and on this fact depends much of its usefulness and popularity. The rapidity of bromide paper varies with the brand and make, ranging from ten to twenty times slower than a rapid plate or Eastman film. Thus it can be manipulated with complete safety in a darkroom where the "safe light" used is ten times stronger than that ordinarily used with plates.

Bromide paper is used for making contact prints from negatives in the ordinary printing-frame and, as a contact printing-paper, has many advantages and desirable qualities not yet fully appreciated. Similarly it may be employed for the reproduction of designs, plans, leaves, lace patterns, etc. Its use for the making of enlarged negatives in the camera, as a substitute for large glass plates, is steadily increasing. Most largely, however, it is used as the simplest and most direct means of obtaining enlarged prints (positives) from small negatives, for which purpose it surpasses any other available medium. In bromide printing and enlarging, the picture image does not appear or print out during the exposure, but requires development as in negative-making, hence it is properly classed as a development paper.

The home preparation of bromide paper is seldom attempted except in an experimental way, because the convenience and excellence of the commercial papers make this labor unnecessary. A reliable method, however, is given on other pages, for the information of those who have asked how such papers are made. The common notion that gaslight papers, such as Velox, are slow bromide papers, is erroneous, these being "washed chloride" papers, i. e., coated with a gelatino-chloride emulsion from which the soluble silver has been "washed." They form a separate and distinct class and cannot be manipulated with bromide papers, although they, too, are known as development papers.

Advantages

The practical advantages of bromide paper are many and well worth the attention of those to whom this paper is unknown. It renders the photographer absolutely independent of daylight and weather in the important detail of producing prints within a limited time. It also enables him to produce more prints more easily in a given time than any other printing process. It offers a remarkable range of color in the finished print, from the silvery grays and velvety blacks of the platinum print to the delicate sepias, dull browns and warm reds obtainable otherwise only by carbon, bi-gum and toned platinum methods. It is everywhere obtainable in a large variety of sizes and surface finishes, from glossy surfaces suitable for mercantile uses to the extremely rough drawing-papers desirable for exhibition and pictorial work. New varieties are being added constantly, the most recent introductions offering tinted bases, which open up a way to many very desirable effects for special subjects. It is wonderfully elastic in its adaptability to different sorts of negatives, so that one might almost say that no special kind of negative is essential in bromide work. This broad claim, however, rests chiefly on the intelligent choice of the particular variety of bromide paper best suited to the negatives in hand. And yet, in the hands of the skilled worker, the actual quality of the negative is of comparatively little moment, the process admitting of so many modifications as to yield good prints from negatives which differ widely in character and quality. Because of this feature, and its latitude in exposure and development, bromide paper is an economical paper alike for beginner and expert, few prints being actually lost, i. e., beyond recovery by means of toning or after-treatment methods. Finally, with reasonable care in manipulation, bromide prints may be assumed to be as permanent as the negatives from which they are made.

Varieties

To name and describe all the different varieties of bromide paper in the American and English markets would extend this article beyond reasonable limits. Since there is little real difference, however, between the products of one manufacturer and another, it will suffice to list the principal varieties in classes, with their outstanding characteristics. Almost all the leading sorts are obtainable in two grades, known as *hard* and *soft*. The *hard* papers give prints with vigorous contrasts and are intended for subjects where contrast is desirable, or for negatives which are over-exposed and under-developed. The *soft* papers are intended for use with negatives already sufficiently emphatic in their contrasts, or for subjects where softness is especially desirable, as in portraiture and certain pictorial themes, as well as for negatives which have density plus and lack detail in the shadows.

First, then, we have thin and thick glossy papers, used chiefly for reproduction and commercial work where the prints need no handwork after they are made. *Second*, thin and thick smooth papers, with a natural semi-dull gloss or sheen, the thin variety for contact prints up to 6½ x 8½ inches; the heavier kind for large prints, illustration and enlargements to be finished in black and white. *Third*, half matt or semi-rough papers, whose surfaces vary within a wide range, such as egg-shell finish, a dull sheen, slightly rough drawing-paper and so on. *Fourth*, matt papers of different weights, having a perfectly matt surface and yielding prints hardly distinguished from platinotypes because of the soft transparency of the shadows and the pearly whiteness of the lights. *Fifth*, rough papers in many varieties of surface finish, weight and texture, sometimes pebbled or grained, and white, cream, gray, aqua-marine, or sea-green in tint, these being intended for illustration or exhibition purposes where broad and sketchy effects are desired. Such papers are also largely used for portfolio and art prints where mounting is not desirable. Beyond these some makers offer thin cardboard in sheets or cut sizes, for postal cards, posters and mercantile use.

The Beginner's Choice

The beginner, before taking up bromide paper, will do well to acquaint himself with the different commercial varieties announced by manufacturers in their catalogues. After this survey, however, he should restrict himself to two or three kinds at most, chosen to meet his individual requirements, and confine himself to these until he is familiar with the broad lines of bromide manipulation. For such a beginning, the following varieties are suggested as sufficiently exploiting the uses and possibilities of bromide paper: Eastman's *Standard A*, thin smooth, for contact prints up to 6½ x 8½ inches; *Platino-bromide* for portraits and outdoor work up to 10 x 12, and *Royal* (white or cream) or *Tiger tongue* for enlarging. The negatives employed in the first trials should be such as are well exposed and sufficiently developed to show a fair amount of contrast, with plenty of detail in the shadows and good gradation.

Caution

Remember at all times that bromide paper, despite its slowness, is light-sensitive and must not be opened or exposed to daylight or any white light except during the exposure properly required for the making of the print. Beginners are apt to neglect this carefulness and will open their packages to withdraw the instructions enclosed therein without due regard to the paper. As bought in the stores the paper is always wrapped in one or two thicknesses of black or orange paper and again enclosed in a stout envelope or roll covering. These wrappings should be opened only in a dark room, and even there without any lengthy or unnecessary exposure of the paper itself. Care should be taken, also, to rewrap the unused sheets after removing the sheet required for immediate use. If this is not seen to, a whole package of paper will often be inadvertently lost by being left open and uncovered while a door is opened or white light is being used. A similar caution is needed in the handling of bromide papers. They retain every mark, touch of the hands, or abrasion of the surface, and should therefore be handled by the edges, as plates or films are handled, and the fingers should not be allowed to touch the emulsion surface at any time prior to development.

The Working Light

The first requisite to success in bromide printing is a safe working light and plenty of it. The bromide room should at all times be comfortably lighted, so that the worker can see what he is doing.

The ruby light generally used in the dark-room is not necessary in working bromide paper; a generous supply of yellow light will give a safe and more comfortable illumination. If the work is to be done in a room having daylight as the source of illumination for all the operations except the actual exposure, then the window should be screened with two or three thicknesses of canary fabric or post-office paper. For incandescent gas or electric light, two thicknesses will usually be enough. For lamplight a single thickness of yellow medium will be perfectly safe. The safety of the light, however, is best determined by actual test if there be any reasonable doubt in the matter. The exposure of a small piece of bromide paper at two or three feet from the light source, for 10 or 15 minutes will at once show, on development, whether there has been any light action or fogging of the paper. Speaking broadly, we can safely use with bromide paper a light ten times brighter than that which we are accustomed to use in developing plates or films. Should fogging be evident during the development of a batch of prints, the safety of the light used in the manipulation should at once be investigated.

Contact Printing

Having provided for a comfortable work-room and a safe working light, we can now take up the making of contact prints on bromide paper. The first question concerns the illumination to be used in actual exposure of the prints. This does not offer any considerable difficulty. Although bromide prints can be made by daylight, artificial light is altogether preferable, simply because it is uniform, whereas daylight varies from hour to hour. We can use gaslight, either ordinary or incandescent burner, electric light and oil-lamp, or even a candle. The point of chief importance is uniformity of the conditions under which the exposures are made, so that when once the correct exposure for a negative has been ascertained, the conditions of illumination, the distance of the printing-frame from the light, and the variety of paper used, may be noted. With these particulars the worker can at any time duplicate his prints exactly without further experiment or calculation. A good working light for contact printing is furnished by an ordinary tin biscuit box with some provision for ventilation and an incandescent gas fixture arranged within the box. One side of the box should be provided with a sheet of opal or ground glass. The well-known Carbutt dark-room lantern is an ideal outfit of this sort ready to hand. Or we may use the ordinary gas jet, turned up full, with a sheet of white cardboard immediately behind the flame to serve as a reflector. An oil-lamp may be used in the same way. Some oil-lamps have bright metal reflectors. In using these, care should be taken to see that the light is reflected uniformly, otherwise the reflector is worse than useless and will give uneven illumination.

The Printing Board

The next step is to provide some means for readily determining the proper distance of the negative from the source of light. This may be simply done by providing a board about twelve inches wide and three or four feet in length. This board should be marked with black lines from side to side, the lines being six inches apart. Or the board may be divided by inches and used in conjunction with the device explained by Mr. Weston on another page. In printing, the illuminant is placed at one end of this board and the printing-frame holding the negative and the bromide paper is set upright upon end or side at any one of the marks on the board, so that the negative is square and parallel with the light. When once it has been found that the negative, at any given distance from the light, gives a perfect print with a good exposure, we can always obtain similar good prints from that negative by using the same variety of paper, illuminant and the same printing distance. The particulars of the first correct exposure should, of course, be marked upon the negative envelope for this purpose.

The Question of Exposure

As the quality of a bromide print depends chiefly upon accuracy in exposure, it will be worth while to give this detail the attention it deserves. First, let us look into the question of illumination and the results obtained by varying the distance between the negative and the source of light in contact printing. We have often read that a strong light overcomes contrast, while a weak light increases the contrast in a print. We are familiar with this in our experience with gaslight papers. But the rule is not as generally employed as it might be. If we take an ordinary negative, such as a landscape with a fairly clear sky, and hold it first six inches from a gas flame and then six feet, we will see that in the first case the sky portion is fairly translucent, while the clear glass portions will, of course, be clear. In the second, the sky will be opaque and the clear glass still clear. The contrasts have been rendered greater simply by removing the negative further from the light source. And this is true in a small degree when the distances are only slightly varied, as well as where we deal with the graded portions of the negative (the half-tones) instead of only with clear glass and the denser portions. This fact can be utilized in bromide printing to very great advantage. It is because we have such unlimited control over the strength of the illumination used that it is possible to get equally good prints from a wide range of negatives. Thus in bromide printing, it is very much easier and more practicable to regulate the illumination by increasing or diminishing the distance of the light from the negative than by interposing sheets of ground glass or opal as is generally done with other processes.

A Working Rule

In varying the distance between the light and the negative, however, we may seem to introduce an element of uncertainty into the problem of exposure. There is a very simple rule which brings the method back to simplicity itself and gives an easy method of quickly calculating equivalent exposures at varying distances from the light source. This rule is: The intensity of illumination varies inversely as the square of the distance from the source of light. For instance, if a good negative requires an exposure of five seconds at one foot from the light, it will have an equivalent exposure if twenty seconds are given at a distance of two feet, the square of one being one and of two being four. Let us see how this works. The shadows in a certain negative will be amply exposed in, say, eight seconds at one foot from the light, but the high-lights of the negative are so dense that no light will penetrate them at that distance from the light in so short an exposure. Hence, a stronger light must be used, or the action of the same light must be continued for a longer time; but the latter will not do, since this will over-expose the shadows. Now, knowing that a stronger light overcomes contrast, we move the negative from the light, where the rule tells us that the equivalent exposure will be one-fourth of that required at twelve inches distance, or two seconds. At this distance, the shadows in the negative get no more light, but it is possible that the high-lights of the negative will be penetrated by the additional force of the light at that distance. Let us take a different case. We have a thin, flat negative, requiring for the shadows an exposure of two seconds at twelve inches from the light. Knowing that we can increase the contrasts by weakening the illumination of the negative, we move this negative until it is thirty-six inches distant from the light and give it eighteen seconds exposure at twelve inches.

Modifications

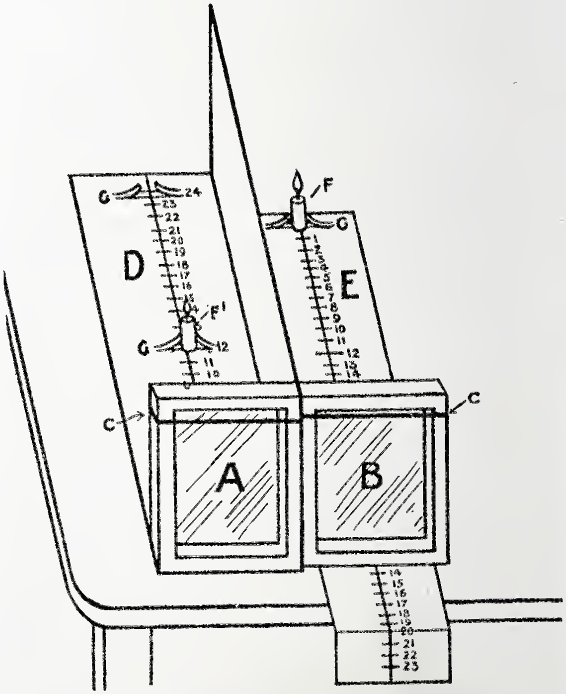
It must not be thought, however, that any given distance between light source and negative will give the same exposures with all sorts of light or with negatives which differ in size. If our light is a Welsbach burner, giving an intense and comparatively white light, we may find that a normal negative will give only flat prints if exposed at 12 inches from such a light. In this case, a distance of from 24 to 36 inches may furnish a better standard. The size of the negative also has its influence on this standard exposure. We must always be careful to place the negative at such a distance from the light that the illumination is equal, or nearly so, at the edges and at the center of the negative. The effect of placing a fairly large negative close to a small light source is to produce a greater degree of illumination at the center than the edges of the plate. This can, at times, be remedied by moving the printing-frame during the exposure, thus equalizing the illumination. A better remedy is to use a stronger light at a greater distance from a negative. It is impracticable to suggest definite exposures without the knowledge of the conditions affecting the particular exposure, such as the intensity of the light employed, the density of the negative, and the rapidity of the paper used. A rough-and-ready plan, where several negatives very much alike in general character are used, is to make a series of graduated exposures giving 6, 8, 10, 12 and 20 seconds exposure respectively and developing these strips at one time in the same developer.

Standardizing Negatives The accompanying diagram shows a contrivance by A. W. H. Weston in *Photography* as an aid in finding a correct exposure for negatives of various densities in bromide printing. Mr. Weston gives his method as follows:

I take a negative of average density, and by trial find the correct exposure at twelve inches from a certain light, getting its print as near perfection as possible. The exposure is then marked on the negative, which I call my test negative, as it is the basis for subsequent printing.

The apparatus, as can be seen from the illustration, consists of two graduated scales, marked off in inches, and a screen between them. Clips are provided on the scales, as shown at F and F′, to hold candles, and two boxes, A and B, provided with ground-glass diffusers are arranged as shown to hold the test and the other negative respectively. And here I may say that the test negative is used not to test the relative time of exposure for other negatives, but the relative distance from the light, in order to make the exposure the same length of time.

To test this, I place the test negative flat to the box A, film side in, and keep it in place with a rubber band. The negative to be tested is put in a similar way flat upon box B. Now if two small pieces of candle are placed in the clips, as shown in the figure, and the scale



E is moved up and down, a point will be arrived at when both negatives appear to be of the same density. The distance at which to put the negative under test from the light for its exposure to be the same as that for the test negative will then be found on the scale E immediately under that negative.

For convenience' sake, it is best to test several negatives before printing, and to mark the number of inches required on edge of each. As several can be exposed at once, it is handy to have a large printing-board marked off with inches radiating from a point where the light is placed. This is easily accomplished with a tape measure and pencil, compass fashion.

I need hardly say that the light used should always be kept constant, and the developer used of the same strength as for the print from the test negative. This is the key to success.

To test negatives that are very much thinner than the test negative, that is to say, if the scale E is pushed right up and the negative still appears too thin, then I remove the candle F′ to the clip at six inches (not shown in the figure); and when the distance is found, the exposure usually given must be divided by four. In the same way, a negative too dense when the scale E reads six inches must be tested with the candle F′ in the clip at twenty-four inches, and the usual exposure multiplied by four. This plan works admirably.

Equipment

Having thus familiarized ourselves with the question of exposure, we can now take up practical work. The light and exposure board are placed on a table or other support ready for use. A couple of printing-frames with the negatives to be printed and a package of bromide paper is at hand. Within easy reach, we arrange three porcelain or white enamel trays. These should be deep, not shallow trays, and an inch or two larger both ways than the prints we intend to make. They should be carefully reserved for their particular use, viz., No. 1 for developing, No 2 for washing and No 3 for fixing. The fixing-bath should be placed at some little distance from the other trays, so that there shall be no fear of contamination by splashes of hypo or transferring hypo on the fingers during manipulation.

Making the Prints

The package of paper is opened at a safe distance from the dark-room light. It is well to cut one sheet into strips of about one inch wide for test purposes, should any difficulties or uncertainties arise in manipulation. There should be no hesitation about the right side of the paper, as bromide paper always curls inward by reason of the gelatine coating. The concave side is the sensitive side. The paper is now placed on the negative with the sensitive side to the film side of the negative and inserted in the printing-frame in the usual way. The frame is now stood on end at the proper distance from the exposure light, and this light is turned up full. As soon as the exposure required has been given, the frame is turned down and the frame covered. The exposure light is turned down or hidden by an opaque screen, and we are ready for development. Taking tray No. 1, we pour in clean water to the depth of three-fourths of an inch or so. The exposed paper is completely immersed by being drawn through the water once or twice, our purpose being simply to make the paper limp and perfectly flat, as well as to avoid the formation of air-bubbles when the developer is applied.

Development

The water is now poured off, the developer (previously prepared in a graduate) is quickly poured into the tray which holds the print, so that the solution occupies the bottom end or corner of the tray and flows over the face of the print with a quick, swirling motion. If the image appears slowly with a lack of detail, under-exposure is indicated. If the details appear quickly and the print is flat and gray, the fault is over-exposure. The correctly exposed print will give its picture image gradually; i. e., the details of the subject will build themselves up in fairly crisp lights and shadows as development proceeds. A very little experience will teach the worker how to distinguish between over-, under- and correct exposure. When development is complete, the print is quickly rinsed in one or two changes of water and immediately put into the fixing-bath, where it should be allowed to stay for at least ten minutes, or until the print is perfectly clear on looking through it. If fixation is not complete, the print will present a somewhat mottled appearance, with yellowish patches. When fixed, the print is best washed by from twelve to fifteen changes of water, allowing the prints at least ten minutes in each water. This method of washing is better than washing in running water, and will repay the extra trouble involved in looking after the prints.

Developers The choice of a developer for bromide paper is an easy matter, as we may use almost any of the modern clear-working developers. The use of pyro is not advised, because of the liability to stain if development is at all prolonged. Metol-hydrokinone is perhaps the favorite with most bromide workers. The beginner is advised to use the formula which comes with the particular variety of paper chosen. A good metol-quinol formula is as follows: Metol, 30 grains; hydrokinone, 120 grains; sulphite of soda, 1 ounce; carbonate of soda, ¾ ounce; water, 48 ounces. When dissolved, add 12 grains bromide of potassium or 100 drops of a 10 per cent solution of potassium bromide.

Metol-Quinol A reliable, two-solution formula is given by Hodges as follows: *No. 1*—Hydrokinone, 50 grains; metol, 30 grains; sulphite of soda, 1 ounce; bromide of potassium, 40 grains; distilled water, 20 ounces. *No. 2.*—Carbonate of potash, 1 ounce; distilled water, 20 ounces. For use, equal portions of one and two are mixed.

Amidol Amidol is considered by many experts to be unequaled for all classes of bromide papers. It is especially advised for use with Eastman *Royal* bromide. It gives prints with rich strong blacks, is clear working and extremely convenient in manipulation. Yellott's formula is as follows: Take 1½ ounces of a 25 per cent solution of sodium sulphite; dried amidol, 30 grains; 5 to 10 drops of a 10 per cent solution of potassium bromide, and dilute this for use with 4½ ounces of water. As this shows signs of exhaustion, add a little new stock solution. Hodges' formula for amidol has given me very good results. It does not keep well in summer time and should therefore be made up just before use or in small quantities. Take sulphite of soda, 600 grains; potassium bromide, 10 grains; citrite acid, 10 grains, and distilled water, 20 ounces. This forms a stock sulphite solution. Just before developing, add dried amidol in proportion of 3 grains of amidol to each ounce of the solution. Stir the mixture well, so that the amidol will be thoroughly dissolved before use. Note that with amidol, the image appears quickly, so that the beginner is liable to think that he has over-exposed. This feature is characteristic of amidol, and sufficient time should be allowed in development to ensure full density in the print, or it will lose in the fixing bath.

Amidol Without Bromide

Some workers do not like the addition of bromide to the developer. Here is a formula in which it is omitted: Amidol, 25 grains; sulphite of soda, 325 grains; water, 10 ounces. This is a normal solution and should be used only when correct exposure is certain. In the case of any uncertainty as to the exposure, add equal bulk of water. It is well, when using this formula, to have a 10 per cent solution of potassium bromide at hand with absorbent cotton mop. In this way, the bromide can be painted on any part of the image which it is required to keep back during the development.

Rodinal

Rodinal is an excellent developer for bromide paper and exceedingly simple. The commercial concentrated solution is diluted as follows: Rodinal concentrated solution, 40 minims; water, 6 ounces; bromide solution (10 per cent), 6 minims. This is said to give warm black tones and is very clean in working.

Ortol

Ortol is largely used by commercial workers. The formula is: *No. 1.*—Ortol, ½ ounce; metabisulphite of potassium, 150 grains; water, 20 ounces. *No. 2.*—Carbonate of potash, 1 ounce; water, 20 ounces. It is advised that the reader take one of these formulæ and stick to it until he has mastered his possibilities, before taking up another.

Fixing

For the fixing-bath, a plain hypo solution is advised. This is made up simply by dissolving 3 ounces of hyposulphite soda in 16 ounces of water. This solution should be freshly mixed and used for one batch of prints only.

In development, it should be remembered that hydrokinone loses its power when the temperature is below 60°. A uniform temperature of between 65° and 70°

will give the best results with all the developers here advised. Black tones are produced by use of the developers just as they are given. If a warmer tone is desired, this can usually be obtained most easily by giving rather more exposure and diluting the developer. It should not be forgotten that bromide prints appear darker in the developer and also that they lose a little density and detail, especially in the high-lights, by prolonged immersion in the fixing-bath. This loss in the fixing-bath is according to the variety of paper used.

Sepia Tones

The sepia tones so much admired for some subjects are generally obtained by the use of a hypo toning bath. After the prints have been developed and fixed and rinsed in the usual way as already described, they are immersed in a toning bath made up as follows: Hyposulphite soda, 5 ounces; ground alum, 1 ounce; boiling water, 70 ounces (dissolve the hypo first in the water, then add the alum slowly). When dissolved, the solution should be milky white. It can be used as soon as it is cold, and improves with age. The prints are left in this bath until the desired shade of color has been reached. The toning may occupy from eighteen to twenty-four hours, and the prints should be moved occasionally. When the desired tone is reached, the prints should be taken from the bath and thoroughly washed. This bath gives rich prints which are believed to be more permanent than those toned with uranium, but its use is troublesome and tedious, as may be gathered from the following description of the method by John A. Hodges.

The toning bath is prepared by making up in bulk a solution of hypo by dissolving 10 ounces of the salt in 70 ounces of hot water, using for the purpose an old iron saucepan. To this solution one ounce of alum is added, with constant stirring; during this operation a strong smell of sulphuretted hydrogen is evolved, therefore it is advisable to prepare the bath out-of-doors. When the mixing is complete, the saucepan must be put on the stove and brought to the boil. Sufficient solution should be prepared to fill a large deep dish, and it will be found to work best after having been used several times. It may be used at once, but the best plan is to allow it to first get cold. Toning is very slow in the cold solution, and it is usually used hot; and as the easiest plan is to heat the dish in which the toning is performed, a large, deep enameled iron dish should be procured, a gas or oil-stove being a convenient method of applying heat. The developed prints should have been allowed to dry, as they do not tone so readily if put direct from the washing water into the toning bath. It is not necessary to give more than a superficial washing after fixing, as the toning bath itself contains hypo, but too long an interval must not be allowed to elapse between toning and fixing, or the traces of hypo remaining in the prints may have an injurious effect upon the image. It is desirable to completely immerse the prints in the tray of cold solution, and allow them to soak for half an hour before applying heat. The alum has a hardening effect upon the film and enables it to withstand a higher temperature. The cold solution will have little or no toning action, and after the lapse of the specified time, heat should be cautiously applied and the temperature slowly raised to about 120°, the prints being turned over and over from time to time to prevent uneven action. A thermometer should be used to test the temperature and prevent the solution being made too hot. After a time, which varies with the character of the print, and the make of paper employed, the color will slowly change from black to a brownish sepia. When the desired tint is obtained, the toning bath should be poured back into its stock bottle, or jar, and the prints thoroughly washed in running water for at least an hour. A powdery deposit will probably be observed on the face of the prints, and this should be carefully removed with a soft sponge or flat camel-hair brush before the washing is commenced. The prints will lose slightly in density, and therefore should be developed a little darker than they are required to appear when finished.

Enlarging

Few branches of photographic work, outside of negative-making, are as fascinatingly interesting as the making of enlarged prints on bromide paper from small negatives. Every amateur has negatives worthy of enlargement in his collection, and the process is so simple as to be within the capacity of the amateur who is still in his first year in photography. Its practice will stimulate his interest and help him in all his other photographic work. Especially will it help him in picture-making, the merits and defects of composition being a hundred fold more plainly evident in an enlargement than in the small print from the hand-camera negative. Moreover, in its essentials, bromide enlarging calls for no special equipment other than the ordinary hand- or view-camera, a few large trays for the development of the enlarged prints, and a dark-room or other convenient work-room from which all "white light" can be excluded on occasion.

Choice of Illuminant

The first question in bromide enlarging concerns the illuminant to be used, whether daylight or some form of artificial light, this choice determining the working method to be followed. The use of artificial light is general, because this gives a constant and invariable illumination, easily controlled, and tending to uniformity in manipulation and results. Daylight is variable, and this leads to uncertainty in the vital detail of exposures, with the consequent loss of time and material. For my own part, I prefer daylight when my leisure will allow, with an enlarging lantern for winter evenings' work, cases of necessity or difficult subjects.

Basic Principles

The general principles on which bromide enlarging is based are as follows: (1) The whole surface of the negative to be enlarged from must be evenly illuminated; (2) the image must be projected by a lens onto a screen, which latter must be so arranged as to be movable, i. e., adjustable at any desired distance from the enlarging apparatus, and (3) the screen must be placed in a room from which all white light is absolutely excluded save that which enters through the lens of the enlarging camera. If these principles are adhered to, it matters little what particular arrangement is followed or what illuminant is employed. Thus the worker may adopt any method which suits his environment, enlarging lantern or special room, home-made or commercial apparatus,

Daylight Enlarging

For daylight enlarging we need a room lighted by a window which has an unobstructed view of the northern sky. An attic under a sloping roof offers an ideal room of this sort if it has a skylight with a northern aspect. On the other hand, some workers prefer a south window as giving softer enlargements from hard negatives. But such a window bespeaks skill and experienced handling. If there are other windows in the enlarging room they should be blocked up, preferably by light wooden frames covered with opaque paper or cardboard. In cases of necessity, heavy curtains and drawn shades will serve the same purpose. If the enlarging window is obstructed by near-by trees or buildings, a large mirror or board covered with white blotting paper or card should be fitted outside the window at an angle of 45° so as to reflect the even light of the sky into the room. In an attic room this is unnecessary, because we have an unobstructed view of the sky.

Preparation

The window is now completely darkened by tacking opaque paper or cardboard from side to side. This should be so done that no daylight leaks through into the room. In this shutter, at a convenient height from the floor, an opening is made, an inch or two larger both ways than the negative to be enlarged from. Around this opening fix grooved wooden strips to hold the negative, which is placed in the grooves, inverted, and with the glass side facing outdoors. The ground-glass being removed from the camera, this, with the lens in place, is supported on a box or bracket and adjusted with its back frame close to the strips around the opening so as to make a light-tight print. The lens, of course, faces into the room. An upright easel or large drawing-board is now placed to face the lens at some few feet distance. The room is darkened and lens uncapped. An image more or less blurred will appear on the screen. If the enlarged picture is to be only slightly larger than the negative, the lens must be racked out until its distance from the negative is but little less than its distance from the screen. To make the enlargement greater, we simply rack back the lens and move the screen further off.

There are tables which show exactly the distance which the lens must be from the negative and screen in order to get an enlargement of a given size. The table here inserted covers the ordinary requirements and may be of service in constructing the apparatus:

TIMES OF ENLARGEMENT

Total distances from the negative, in inches

TIMES OF ENLARGEMENT	2		3		4		6	
Focus of Lens	To Easel	To Lens	To Easel	To Lens	To Easel	To Lens	To Easel	To Lens
6 inches	27	9	32	8	37½	7½	49	7
8 "	36	12	42⅔	10⅔	50	10	65⅓	9⅓
10 "	45	15	53⅓	13⅓	62½	12½	81⅔	11⅔
12 "	54	18	64	16	75	15	98	14

Focusing It is advisable to focus the enlargement with the largest aperture of the lens. If the lens, when working at its largest aperture, covers the plate from which the enlargement is being made, it will give proper definition over the enlargement. With a lens of the better sort, of course, the definition will be equally good whether a large or small aperture is used; but with a low-priced lens it is better to stop down to No. 8 (*f*/11.3) or No. 16 (*f*/16), to avoid spherical aberration. Stopping the lens down increases the time of exposure, and enables one to have greater control over the operation of exposing the paper, permitting time to shade or locally increase the exposure at any portion of the image. This is sometimes useful, but as a general thing stopping the lens down is not advisable, as interfering with one's judgment in calculating exposures for various negatives. Having secured the image correct in size and focus, place thumb-tacks at all four sides of the sheet of paper or card used to focus the image. These will serve as a guide to the placing of the sensitive paper. Adjust the lens stop as desired and cap the lens, leaving the room totally dark save for such safe light as we may have for working. Place the bromide paper on the screen, using thumb-tacks as a guide to the correct position in this.

Making the Exposure

In making his first enlargements, the beginner should avail himself of the help of test-strips. These should be about one inch wide and the length of the paper. The exposure depends on a number of factors, among which are light, negative, focal length of lens, size of enlargement, stops, sensitiveness of paper, developer, temperature of developer, and length of development. The first experiment had best, therefore, be made on a purely arbitrary basis, for which we will take ten seconds.

Pinning a test-strip on the screen, we uncap the lens and with a piece of cardboard shade two-thirds of the strip during five seconds; move the cardboard, and give the next section five seconds, making ten for the first; then remove the cardboard entirely and give five seconds more, making fifteen for the first, ten for the second, and five for the third. Now develop the strip. If the fifteen-seconds portion finishes development in less than one minute, and the ten- takes approximately a minute, we will know that our basis was correct. But if all three were over-exposed or under-exposed, as shown by one minute's development, we can expose the next test-strip accordingly. Any of the developing formulæ suggested for contact printing may be used in enlarging, either by daylight or artificial light, the treatment of all classes of bromide prints after exposure being identical.

Variations in Equipment

From this description of daylight enlarging, it will be apparent to the reader that the method and apparatus employed will admit of endless modification to suit individual conditions or requirements. The important point is to grasp the essential principles, after which variations will suggest themselves as the need arises. Thus, for enlargements of moderate size, such as 10 x 12 inches from 4 x 5 negatives or smaller, a large square bellows camera, such as can often be obtained cheaply at second-hand, may serve in place of the enlarging-room, as in the method given by Mr. Claudy on another page. Or the reader, handy with tools, can readily make for himself a "fixed focus" enlarger such as may be seen in the stores. The principles here laid down are alike in all enlarging apparatus.

Enlarging with Artificial Light

The use of any form of artificial light for enlarging requires two additional pieces of apparatus; viz., a light box for enclosing the illuminant chosen, and a pair of condensing lenses. The method of procedure is the same as that advised in daylight enlarging. For the illuminant we have choice among the following: electric arc light (for commercial work, unusually dense negatives or enlargements of unusual size); the powerful incandescent electric lamps recently introduced for optical projection; the oxyhydrogen light; incandescent gasolene-vapor light; acetylene incandescent Welsbach light, and oil lamps such as are used in optical lantern work. These range in illuminating power about in the order given. But the devising and construction of apparatus for their use is both tedious and expensive, and the proper adjustment of light, condensers and lens is not an easy matter for the unexpert. Hence it is advised that the reader consult his convenience and pocketbook by investing in a commercial enlarging lantern, such as the *Ideal*, made by Burke & James, or the *Bright White-Light Outfit*, made by Williams, Brown & Earle, the Hume *Cantilever* apparatus, etc. These instruments are moderate in price and make the process of enlarging easier and more certain than can be expected with make-shift apparatus.

The exposure required will vary according to the illuminant used, the density of the negative, the lens aperture and the size of the enlargement, and may be anything from five seconds to fifteen minutes. The exposure and development of test-strips is the surest guide in this detail until the reader has gained that experience which will enable him to calculate his exposures with a reasonable assurance of success.

Dodges

It frequently happens that a negative may require more or less dodging in printing or enlarging. With bromide paper this is particularly easy. We will take the simple case of a negative with a dense sky which will not print out in the ordinary way. All that we need in this case is a piece of paper cut roughly to the sky-line and kept moving during part of the exposure over the part which is to be held back. If necessary, cut down the light in order to prolong the exposure, or expose at a greater distance from the light. One or more test-strips will be required for this purpose in order to ascertain the relative times of exposure. A modification of this method is when a small portion of the negative only needs extra printing—a face or hand, for instance. Here we take a piece of paper a little larger than the negative and cut a small hole in it, moving it in front of the light so as to throw the latter only upon the portions needing the extra printing. Still another modification is where a portion only needs holding back. Here we use a small piece of paper or cardboard stuck on a knitting needle, moving the latter so that it will not intercept the light too long at one place.

In all these and similar instances which will occur to the reader, the dodging should be done during the first part of the exposure. The subsequent exposure seems to obliterate traces of such dodging better than when it is done at the end of the exposure, just as in cloud-printing better results are achieved by printing the sky first and the foreground afterward.

Vignetting

The best arrangement for vignetting in enlarging is a piece of cardboard the size of the negative, with an opening cut out at the proper place and about the size of the portion of the negative to be vignetted. This is held near the lens and moved backward and forward between the latter and the screen, the opening showing larger as we near the lens and smaller as we recede from it. Very tasteful vignettes can be made in this way.

Bromide Enlarging in the Camera

BY F. F. SAXE

Many amateurs whose photographic facilities are limited to a closet under the stairs or a bathroom which cannot be occupied for an extended time, are deterred from the making of bromide enlargements by the idea that a specially prepared room is necessary, or that they must have an enlarging lantern with condensing lenses and the expense therewith connected. There is no reason, however, why any one with a knowledge of negative-making and a box with plate-holders, should not enjoy this interesting process, using the only means at hand and without any extras except a table and a window.

Of course, enlarging in the camera has its limitations. If you have but one camera, you can not make an enlargement greater than the size of the negative which that camera will make. And, therefore, if you wish to enlarge the whole of a negative, you cannot do it in this way. But there are many negatives of which we desire to enlarge only a small portion,—perhaps a head out of a group, or a small part of a landscape. For this class of work, the substitution of bromide paper for plates and the photographing of a portion of the negative on this paper in the camera is an easy, certain and pleasant way of making enlargements, even if the reader possesses but one camera.

Requirements

In the first place, we shall require some device for holding the negative during the enlarging. Second, some arrangement for uniformly and evenly illuminating the negative to be enlarged. Third, some means of holding the bromide paper perfectly flat in the ordinary glass plate-holder. Fourth, some way of improvising a light shield or tunnel to inclose the space between the negative and the camera. These requirements can be easily provided.

Negative Support

The negative can be most easily supported in any position by placing it in an ordinary printing-frame with the film side of the negative as in printing. As the hinged back of the printing-frame will not be in its usual place, we must secure the negative within the printing-frame by small tacks at the corners. It is important that the negative be set closely against the rabbet of the printing-frame and securely fastened. It is also important that the outside of the frame shall be truly square with the negative when so placed, in order that, when the frame is set upright on edge on a table, the negative will be upright and perpendicular to the horizontal plane of the table on which it stands.

Illumination

In illuminating the negative for enlarging, by which we mean the letting through the negative of an even volume of light all over the plate, it will depend somewhat upon the size of the negative from which the enlargement is to be made. Let us presume that the largest negative in use is 5 x 7. The table on which the enlarging is to be done should be pushed up close to the window chosen. This window should not be lighted by the direct rays of the sun during the enlarging. A north light or window facing a northern sky is preferable, but either east or west exposure will do if the time of day is properly chosen so that the sun is on the other side of the house. Even a southern window can be used on cloudy days, but it is better to secure the north light if at all possible. The window itself should be raised, so that the bars holding the glass do not interrupt the light striking the negative. A piece of white cloth tacked to the edge of the raised sash and secured to the sill with two or three tacks provides a very good diffusion of light for a small negative. Ground-glass, if not too fine in grain, will serve equally well and is more convenient, excepting the liability of breakage.

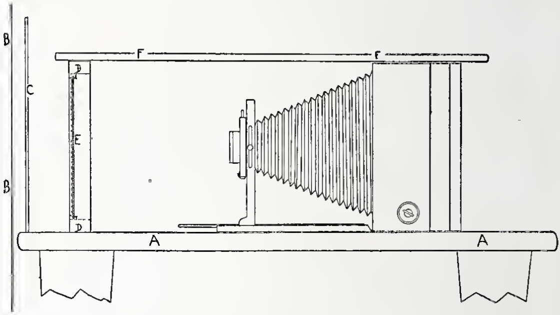
Holding the Paper

The bromide paper may be secured or fastened in the plate-holder in various ways, depending somewhat on the internal construction of the holder employed. Some plate-holders (such as those in which the plate is inserted from the end through a slit left by removing a cap) allow the insertion of a sheet of bromide paper without any further preparation than removing the spring which presses the plate outward in ordinary use. Generally, however, the most satisfactory plan is to confine the paper between two selected sheets of thin and perfectly clear glass, or between a sheet of glass and a piece of tin or ferrotype board. In an emergency, the glass here used may be a cleaned negative, flawless and polished as perfectly as possible before use. The bromide paper is laid, sensitive face to the glass, between the two sheets used and thus inserted in the plate-holder just as we put in a plate. Of course, this operation must be done in the dark-room, although we may use a deep yellow light, instead of the usual ruby light, with comfort and safety.

Excluding Light

Finally we need some way of excluding the light from the space between the negative close to the window and the camera, which will be placed at some little distance away. If it is inconvenient to make a cardboard tunnel fitting closely to the printing-frame at one end and the camera front at the other, then a couple of thin sticks extending from the back of the camera to the top of the printing-frame, and a focusing-cloth thrown across these sticks and reaching down to the table on either side, will be all that is necessary. This excluding of the light between negative and camera is all according to the books. I have made many bromide enlargements by the means here described without any connection at all between the negative from which I was enlarging and the camera, and they were quite as good as those obtained with the more elaborate plan. At the same time, the excluding of extraneous light from reaching the lens is, theoretically, a good thing,

The diagram here given will illustrate the arrangement of camera, negative, etc. **AA.** Table. **BB.** Window, before which table is placed. **C.** Ground-glass or diffusing screen before the window, supported on the table with any convenient means, such as a book. **DD.** Printing-frame, with wooden back removed, set on end before ground-glass and containing the negative. **E.** Negative held in position with pins or tacks at the corner. **FF.** One or two rods laid from the top of the camera to the top of the printing-frame, and over which the focusing or other dark cloth is draped to exclude the light between the negative and the lens.



Bellows Extension

There is a further consideration which must not be overlooked, viz.: The length of bellows-draw of the camera in proportion to the focal length of the lens used. If the draw of the bellows is not more than twice the focal length of the lens employed, you cannot enlarge. Thus, a 12-inch lens with a camera of 24 inches bellows extension cannot be used for enlargements, inasmuch as the bellows-draw entirely extended will only permit of an image of the same size as the image of the negative from which the enlargement is desired. The remedy is to use a lens of shorter focal length. If the reader does not possess a lens of shorter focal length and does not want to purchase one for this particular use, a supplementary lens may be used. These are single element lenses or glasses in frames which fit over the lens like a ray-screen or filter. These supplementary lenses are usually inexpensive and cost a dollar or so, and are, perhaps, not to be advised if other means are at hand, inasmuch as they do not add anything to the optical quality of the ordinary lens. Yet I have seen enlargements made with these supplementary lenses which were all that could be desired.

I trust that I have made the few simple points of this method plain, so far as the arrangement of the apparatus goes: the screen at the window, the negative in the printing-frame, film side toward the camera; the camera on the table pointing square at the negative and properly parallel with the film, and the arrangement completed for focusing with the two sticks laid from camera to frame and covered with the focusing cloth, and the bromide paper in the plate-holder flat between glass and glass or glass and tin as mentioned.

Focusing

I have purposely neglected one small but important point, not wishing to confuse the reader. Here it is: The sensitive surface of the plate, as ordinarily used, is on the outside of the glass in the plate-holder. In the arrangement of the negative here described, the sensitive film is behind a sheet of glass in the holder. This will necessarily make a slight difference in the focus of what you see on the ground-glass and what you get on the paper, the difference being caused by the thickness of glass covering the bromide paper. In other words, the sensitive film of the paper is the thickness of its protecting glass behind the focal plane in which the image will necessarily be focused. There are two ways of overcoming this difficulty. Either measure accurately the thickness of the protecting glass in front of the bromide paper and alter the focus to that amount (which must be done with the back focus) and of course, by diminishing the distance between ground-glass and lens; or, substitute for your usual ground-glass another sheet as near the thickness of the covered glass in the holder as is possible, and put this in place in the focusing glass frame with the ground side of the glass to you, instead of focusing into the camera as usual. This device is not so necessary if the lens of very short focus is used, and stopped away down, the stopping down of the lens by means of a small diaphragm taking care of the slight difference in the focus.

Choice of Papers

Now, as to the actual method of enlarging. It has already been explained how to insert the paper in the holder. Bromide paper comes in many grades, surfaces and varieties. Just as in contact printing, the reader should select the proper variety of paper for the negative. For while bromide papers are all made on the same general plan, their properties are very different. Most varieties, for instance, are sold in hard and soft grades, the distinction being in the amount of contrast the different papers give with a definite exposure on the same negative. Unlike the hard and soft "gaslight" papers, there is little, if any, variation in speed in hard and soft bromide papers. But there is a difference in speed between papers made by different manufacturers. For small work,—that is, enlargements on paper not greater that 5 x 7 inches,—it is advisable to choose the smooth or semi-matt and matt papers, the rough-surfaced papers being generally too sketchy for small work.

Manipulation

Having selected the right paper and inserted it in the plate-holder in the dark-room, the camera should now be focused. Do this with the lens wide open, that is, without any diaphragm in the lens. The size of the image projected on ground-glass when the lens is pointed at the negative will depend on the bellows extension of the camera and the focal length of the lens. The more the bellows is extended, the closer will the lens have to be to the negative. Having secured on the ground-glass an image which in size gives the desired degree of enlargement, focus the image carefully by drawing the whole camera away from or bending it toward the negative. In this be scrupulously careful to see that the camera is at all times at right angles with the negative, and that the back of the camera (in which the plate-holder will be inserted) is perfectly parallel with the top and bottom of the negative. If this advice is neglected, the picture may be distorted and the sharpness of the image will not be uniform. With regard to the diaphragm in the lens, it will generally be found advisable to use a stop at least *f*/16 (not larger) and often smaller. The reason is that slight errors in focusing are thus corrected. However, the exposure necessary will have its influence upon the stopping down of the lens: with a dull light and dense negative, the exposure will be undesirably long if the lens diaphragm is very small. This point is therefore determined by local conditions or limitations.

Exposures Development As to the calculation of exposures, little can be said. An experiment or two will give the easiest and most reliable guide. Cut up a few strips of paper, place them one at a time in the plate-holder as described, make a few successful exposures starting with 30 seconds at *f*/16 and a negative of average density. Develop two or three of these exposed trial strips in any clear working developer, such as metol-hydro, amidol, etc. Development should be complete in a minute or two. If the exposure was not right, a trial or two in this way will give the correct time. Once the proper exposure with a good light and any particular negative is known, this will give a guide for exposures with other negatives where there is not great variation from the standard.

Briefly To sum up, the points to be remembered in this method of enlarging are in brief: 1. Negative upright and perpendicular to the plane of the table; 2. The film side of the negative toward the lens; 3. Soft and even illumination. (Here let me add that the distance between the negative and the window, while a matter of experiment, should at least equal the diagonal of the negative. If very far from the light the exposure will be unduly prolonged.) 4. The camera to be perfectly square with the plane of the negative; 5. Allowance to be made for the thickness of the glass protecting the bromide paper in the plate-holder, or the ground-glass screen to be reversed; 6. Care when inserting the plate-holder containing the bromide paper, so that the camera is not moved between focusing and exposure; 7. Carefulness during exposure to prevent any movement of the apparatus. Walking around the room or any sudden movement will often jar the table or the apparatus.

This method should not be regarded as too much on the order of a makeshift. Although somewhat rough-and-ready, it offers an excellent way to get acquainted with enlarging and without a great deal of preparation or special apparatus. If the process takes hold of you, as it does with most amateurs, your experience with it will enable you to devise a better and more substantial equipment. But with all the facilities the market affords, for small work and occasional use at home or away from home, this method gives ready access to the use of bromide paper for enlarging, and materially increases the scope of the amateur's work and, with a little care, will give results unsurpassed by the more elaborate equipment.

Toning Bromide Prints

BY C. H. CLAUDY

It has been said, with more or less truth, that no photographic paper is as flexible (that is, as easily controlled in manipulation and variable in results) as bromide paper. With skilful handling it may be made to yield a remarkable variety of effects, and is suitable to almost any kind of negatives. There are, however, limits to the flexibility of bromide paper. Manipulate it as you will, you cannot obtain on bromide paper all the colors you can get with carbon or gum and its allied processes. On the other hand, a very wide range of colors can be had in bromide paper with less trouble and greater ease in working than with carbon. Furthermore, we can get good prints on bromide paper from negatives which are hopeless with carbon tissue, and we can obtain colors on bromide paper from some negatives, which, if printed in carbon, would result only in a disagreeable smudge.

The Range of Colors

As every reader knows, bromide papers yield, with ordinary development, black and white prints with a wonderful range of silvery gray half-tones, very similar to platinotypes. It is possible to obtain many variations of color in the finished bromide print by modification of the developer or by means of the well-known alum-hypo bath, but with these methods this article has nothing to do. Whatever may be said in favor of these methods of obtaining colors in bromide prints, the range of colors available is limited and chiefly confined to olive-green and sepia browns. With the methods of toning bromide prints with uranium and perchloride of iron here to be explained, we can get tones ranging from warm black, through deep browns, light browns, sepias to red-browns, warm reds, brick reds. and on to green, green-blue and blue.

There are many different formulas for the uranium toning of bromide prints, and I suppose that most of them have given good results with the workers who published their methods. Of those which I have tried, however, none has yielded the results which I have been enabled to obtain from my own formula—my own in that I arrived at it by patient experimenting. It may be that this formula is not wholly original with myself. At any rate, I do not claim anything for it except that it works, with me, better than others I have tried.

The Formula

The requirements for toning bromide prints with uranium are: 1 ounce of uranium nitrate; 1 ounce of potassium ferricyanide (the red crystals); ½ pound bottle of acetic acid—c.p. glacial preferred; water; a supply of blotting paper, to be kept exclusively for this purpose, and a few absolutely and chemically clean trays.

The expense attached to these toning processes is slight. Uranium nitrate costs from forty to sixty cents per ounce, and an ounce will last a long time. Potassium ferricyanide costs about twenty cents per pound, and a pound is ample for a lifetime. Glacial acetic acid is a little more costly, but a half-pound bottle will prove a good investment. It is used also, as the reader will recall, in making acid hypo for acid fixing.

The Toning Baths

To prepare the toning baths, dissolve the ounce of uranium nitrate in 10 ounces of water. The water should be distilled if this is easily obtainable, and the solution should be kept in an orange-glass bottle or an ordinary bottle protected from light by a non-actinic paper wrapping. Dissolve the ounce of potassium ferricyanide in 10 ounces of water. Keep this also in an orange-glass bottle, well corked. There are many cautions about this particular salt, and it has been said that it will not keep in solution. In my practice I find no difficulty whatever in the use of a solution six months old, despite the difficulties mentioned in the text-books.

Uranium and Ferricyanide

To tone the bromide prints, first note that the prints should have been developed and fixed and washed just as usual. It is necessary that prints to be toned shall contain no trace of hypo. To secure this, the prints should be specially prepared for toning by being again thoroughly washed, as any hypo remaining in the print will cause spots and streakiness. With care at this stage the toning will give clean and bright prints, which should be as permanent as the original bromide print.

I cannot give the reason why, but, as a general rule, bromide prints tone better if the print has been dried after washing and rewet just before toning. There may be a chemical reason for this, but I am inclined to think that it is a physical one, viz., that the emulsion is softer after its first washing than after having been dried and wet, so that it allows toning solution to get into the film more quickly. This naturally results in more rapid toning, and quick toning does not yield as good prints as a slower and more gradual building up of the color image.

Having the print ready for toning as here outlined, take 1 dram of the uranium solution, add ½ dram of acetic acid and then 5 ounces of water. In a separate graduate put 1 dram of ferricyanide solution and 5 ounces of water. Just before toning, pour these two solutions together into the third graduate and use immediately. To proceed, lay the rewetted print face up in a clean tray and flow the freshly made toning bath (the two solutions combined) over the print. The print and tray must be kept in motion by gentle rocking during the toning operation. The toning solution tends to throw a red precipitate as it works. This precipitate should not be permitted to settle on the face of the print. Some workers tone their prints face down, but I do not advocate this, as it is important to take the print from the toning bath at just the right moment, and, as the toning process is short (six or seven minutes is usually sufficient even for the deepest red) you need to watch the print all the time. In the toning operation note that a constant quiet motion of the tray, to keep the solution moving over the print, is essential to success.

Variations in Color

I have already given, in an earlier paragraph, the order in which the colors come. But that order was for a normal print. Some prints behave differently, and it is in the control of these unavoidable variations with different prints that skill and success come. A print of a half-tone subject against a jet-black background, a portrait for instance, will hardly follow the normal order in the appearance of colors. This because the half-tones will be brown and even red-brown before the toning solution has changed the dense black deposit of the background at all. If the toning was stopped at this stage, some very pretty effects in double toning might result. Note here that it is this faculty of a uranium solution affecting the delicate detail and half-tones in a print before it touches the deep blacks, which makes this solution valuable as an intensifier for a plate, giving increased printing density to shadow details in the negative before it seriously affects the high-lights.

Choice of Prints for Toning

From this explanation of the toning process, the discerning reader will perceive the need for caution in selecting the best kind of a print for uranium toning. Thus a print which has a bald-headed sky will tone only in the body of the print, but if there is any tint at all to the sky, it also will tone, giving an effect not much to be desired except for sunset or sunrise pictures. If white high-lights are desired in the toned print, they must be white originally and not the least bit fogged. As double-toned effects in a print are not usually desirable, those prints having deep black shadows or dark masses will be avoided. The best kind of print for this method of toning is one fully exposed and slightly under-developed, since, when the uranium does take hold of the shadows, it makes for an increase of contrast.

Experience is the best teacher, and if I could occupy a whole number of this magazine, I could not begin to describe in detail what the reader can himself ascertain from a few experiments. Some prints needing contrast should be carried far in the toning solution; others, not needing contrast, will give better results if they are toned only through the browns, and so on. The reader who can spend a Saturday afternoon with a few bromide prints, varying in character, will learn more from his experimenting than I could tell him in many pages.

Washing

When the desired tone is reached, remove the print from the toning solution and wash quickly and well in running water for fifteen minutes. If washed too long, the color of the print will fade and a dead and lifeless print will result. If not washed long enough, the yellow of the ferricyanide will remain in the print, robbing its gradations of brightness and purity of color and impairing the permanency of the print.

A big advantage in this method of toning is its wonderful adaptability. There is no hard and fast rule as to the proportion of the chemicals to the bulk of water used. Try two drams of each of the two solutions; then three drams of each, but watch that the print does not get beyond you in toning. The only practical difference in my formula and others that I have seen is, that I make my stock solution weaker than that ordinarily advised and use less of it to a certain amount of water, because I prefer slow toning and the accompanying ease of control which the flash-in-the-pan formula does not admit. Quick toning, like quick development, tends to block the shadows in the print, and if you once get bronzed shadows the print is practically hopeless. Not quite ruined, however, as a bath in a 5 per cent solution of sodium carbonate will discharge the color and then, if the print is faded, it may be redeveloped in an alkaline developer such as metol-hydro. But before it is retoned the print must be thoroughly washed, as the presence of sodium carbonate does not permit the toning solution to do its work.

Finally, I may say that, while a bath of acetic acid and water is often advised to stop the toning action in this method, I have never found it necessary.

Iron Perchloride Toning

To tone bromide prints with perchloride of iron, we first tone the print with uranium as above described, wash, dry and then rewet the print. Make up a solution of any desired strength from 5 grains of perchloride of iron to 1-10 of a grain to the ounce of water and immerse the uranium-toned print in this solution As the tone of the print changes, you will get greens, green blues and blues, and seldom any two prints alike. At first you will have some failures and some successes, and the successes will exceed the failures as you gradually get experience. By this I mean that a little experience with this method will quickly tell you that a print toned somewhat lightly with uranium, and not at all blocked up in the shadows, will yield much better results in the perchloride bath than a print which has had more thorough toning in the uranium bath. Perchloride of iron is inexpensive, so that the perchloride toning solution should be made up fresh every time it is used, and should be used in a weak solution rather than in a strong solution. A curious fact is that the weaker the uranium tone, the stronger the perchloride solution may be without ill effects; the stronger the uranium tone, the weaker the perchloride solution should be for the best results. When the desired tone is reached, remove the print and wash for fifteen minutes and dry.

Double Tones

Peculiar double-toning effects can be obtained by the use of a weak perchloride solution on a weakly toned uranium print with deep shadows—when the shadows will stay brown and the half-tones turn green or greenish blue. I do not think this particular process pleasing in its results, but it is a matter of taste, and some double-toned effects are more pleasing with some subjects than with others. It is an interesting experiment, at any rate. If the result does not please, the color may be discharged with a 5 per cent solution of sodium carbonate as directed in uranium toning, redeveloped, washed and again toned.

Specks

A trouble often experienced in uranium toning is the appearance of bright blue or green specks on the toned print. This is the result of traces of iron in the paper, the trays or impurities present in the chemical salts. I know of no way to get rid of these except to spot them with water color afterwards. They are not usually numerous or large, and, of course, perfect cleanliness in manipulation will help in avoiding them.

Permanency About the permanency of toned bromides. It is commonly said that uranium toned bromides are not permanent. But I have prints more than five years old which are as bright and unspotted as the day they were made. Some are under glass, others simply mounted for portfolio use. I have some prints also which have not preserved their pristine purity, but these were all early attempts and, I suspect, were not thoroughly washed or thoroughly rocked in toning. Some of these defective prints are on smooth paper, and I have found that rough paper prints tone better than the smooth. To sum up, the essentials are: the complete elimination of hypo, care in the making up solutions and the use of fresh solutions, keeping the solution in motion during toning, thorough and quick washing after toning, and an intelligent selection of the proper kind of prints for the toning method followed.

Making Bromide Paper or Bromide Linen at Home

BY A. J. JARMAN

Despite the practical convenience and abundant variety of commercial bromide papers, there are those who, for one reason or another, want to prepare their own paper or to know how it is done. Others have use for a sensitized fabric, such as the bromide linen or canvas employed for various mercantile uses, and cannot find this material in the market. Hence it may be profitable to give here a reliable method, with formulæ, for the preparation of bromide paper or linen on a small scale.

Apart from the time and layout involved in the preliminary making ready, there is nothing difficult or troublesome in the making of bromide paper. As a technical process it is well within the capacity of the amateur or professional inclined to experiment. Certainly the making is simpler and less tedious than the telling how to go about it.

Paper

First, we require a supply of paper suitable for photographic purposes. Such are the Rives, Saxe and plain photographic papers obtainable from most of the larger photographic supply houses. The importers are G. Gennert, Geo. Murphy, Inc., and Paul Puttman, of New York. American papers can be had from the Valley Paper Co., Holyoke, Mass. Special varieties, such as Whatman's toned crayon, hand-made hot pressed, Crane's heavy bonds and Japanese vellums must be sought for at artists' and draftsmen's supply stores. Baryta coated papers suitable for photographic use are not dealt with here, being very difficult to obtain and troublesome in manipulation. The smooth papers chosen should be quite "plain," i. e., not coated or impregnated with salting solution, such as are offered for plain silver printing. If the paper is purchased in large sheets or from the roll, it should be cut into pieces about 16x20 inches for convenience in handling and storing flat under pressure. Rough-surfaced papers are usually cut from a wide roll and are sold by the running foot or yard.

Working Tools

We will also need a few strips of glass, about one inch wide by ten inches in length; a few dozen paper clips, such as the U. S. Photo Clips, made of hard wood with a heavy wire spring; also three or four dozen strips of wood, one-half inch wide, one-eighth inch thick and ten inches in length. These should be cut from white wood, such as willow, not mahogany or oak. Clean and smooth these strips with sandpaper, and give them two coatings of hard shellac varnish. The tips of the paper clips should be varnished at the same time. This will prevent any possible contamination of the emulsion, and enable us to keep strips and clips clean during all operations by means of a wet sponge and warm water. With these we need a half-gallon stoneware crock with a stoneware lid—one which will stand securely upright; an agate saucepan or two large enough to contain the crock under cover; two or three stoneware pitchers; a porcelain tray, and a few clean, wide-mouthed amber-glass bottles of about 16 ounces capacity.

Chemicals

The chemical supplies required are as follows: Silver nitrate, 1 ounce; potassium bromide, 1 ounce; potassium iodide, 1 ounce; Heinrich's hard gelatine, 1 pound; muriatic acid, c.p., 1 ounce; photographic alcohol, 1 pint, and distilled water, one-half gallon. In all emulsion-making distilled water only should be used, except where otherwise specified; tap and well waters usually contain impurities liable to spoil the emulsion or give unnecessary trouble in its preparation.

Mixing the Ingredients

With these supplies ready at hand, a batch of emulsion may be prepared as follows: No. 1. Distilled water, 6 ounces; potassium bromide, 330 grains; gelatine, 80 grains. No. 2. Distilled water, 6 ounces; silver nitrate, 400 grains. No. 3. Distilled water, 20 ounces; potassium iodide, 12 grains. No. 4. Take 1 ounce of hard gelatine, cut into shreds and cover it with distilled water, allowing it to soak and swell therein.

When the salts in Nos. 1, 2 and 3 are dissolved, which may be hastened by stirring with a flat glass strip, No. 1 should be thoroughly mixed in the stoneware crock. Tilt the crock to one side, so that the relatively small bulk of solution can be easily and thoroughly stirred. When the gelatine has become well soaked and swollen, add 1 ounce of distilled water to which 4 drops of muriatic acid have been added. The crock should now be placed in a saucepan or other container of warm water, so that the crock stands in quite 2 inches depth of water over a small gas stove or other heater.

Cooking the Emulsion

All the operations from this point on should be conducted in the dark-room or by ruby light. As soon as the water about the crock has boiled for about ten minutes, stir the contents well with the glass strip and add solution No. 2 gradually, with continual stirring. Now add the iodide solution No. 3, stir the mixture thoroughly, put on the stoneware lid of the crock and cover the saucepan with its proper lid. Keep the water surrounding the crock slowly boiling over the stove, occasionally adding a little more water as needed to compensate for evaporation. The boiling of the emulsion as here described should be continued for from 40 to 50 minutes, the mixture being well stirred with a glass strip every 10 minutes or so, and care being taken to prevent any water dripping from the saucepan lid into the emulsion.

When the emulsion has boiled 40 or 50 minutes, drain off the excess of water from the gelatine (No. 4) and add the soaked and swollen mass of gelatine to the emulsion in the crock, stirring continually during this addition. Keep up this stirring until the whole mass is well incorporated and thoroughly dissolved, which will occupy about 5 minutes. Replace the stoneware lid on the crock, remove the latter from the saucepan and stand it aside in a cool place to set the emulsion. If prepared at night, the emulsion will be well set by the following morning.

Washing the Emulsion

The next step is to wash the emulsion. This is done by lifting the clot of emulsion from the crock, pressing the fingers down the side of the vessel and lifting the emulsion as a mass of jelly. Place it on a clean plate or tray and break it up into several pieces. Provide a piece of coarse canvas without coloring matter, such as mosquito netting or the coarse muslin used by ladies for woolwork. Place a piece of the emulsion jelly in a square of this canvas of convenient size and fill the stoneware crock two-thirds full of cold water from the tap. Now fold the corners of the canvas containing the emulsion to form a loose bag, and wring the emulsion through the meshes so that it will drop into the water in the crock. Repeat this operation until the whole of the emulsion has been washed in this manner. Now tie a piece of clean cheese-cloth (butter linen) securely over the tap of the crock, and turn it upside down so that the water will be completely drained off. Fill the crock again with cold water by running the stream from the tap over the cheese-cloth cover, allow to soak 10 minutes or so, and again draw off as before. After four such washings the final draining may take place. When thoroughly drained, turn the crock up, remove the cheese-cloth and the emulsion is ready for melting previous to coating the paper or linen. Of course, all these operations should be done in a weak ruby light, as the emulsion is now light-sensitive.

Preparing Paper for Coating

To prepare for coating the paper, place the sheets of paper ready at hand and lay one sheet upon a clean level table. Now take four of the varnished wood strips. Place one strip under one end of the sheet of paper and a strip on top of the same end of the sheet, gripping the two strips together with three paper clips, so that the sheet is rigidly held between the strips. Turn the sheet of paper about and fix the other end in exactly the same way. The sheet is now held securely and without unevenness or wrinkling at each end between the varnished strips. Prepare as many sheets in this way as it is intended to coat with emulsion, laying them on top of each other as prepared.

Filtering the Emulsion

The emulsion should now be melted by standing the crock in a saucepan of hot water over the gas stove. As soon as the emulsion is melted, about 1 ounce of photographic alcohol should be gently added, with constant stirring during the addition. This done, the emulsion is ready for filtering. Take a clean glass lamp-chimney and fasten a double thickness of well-washed cheesecloth over the narrow end. This rough-and-ready filter is now inverted, placed on a retort stand or any other suitable support with a hole or holder in which the chimney may be held securely, and upon the cheesecloth within the chimney a tuft of absorbent cotton is packed. Now place a small stoneware jug or similar container beneath the filter thus made ready, so that it will receive the filtered emulsion as it drops through the cheese-cloth.

Hand Coating

A clean porcelain tray will be needed to hold the filtered emulsion during the coating operation. This should be sufficiently wide to allow the full width of the sheet of paper to be coated to rest upon it evenly. Thoroughly warm the tray by filling it with hot water; pour the hot water off and very carefully pour in the filtered emulsion from the pitcher, so that no air-bubbles are allowed to form.

This is most easily managed by flowing the emulsion gently from the pitcher upon the inner edging of the tray. The tray should now contain an even depth of emulsion. Place the ruby light in such a position that the whole surface of the emulsion can be seen at a glance. Lift one of the sheets of paper from the pile, having marked the back of the sheet with a pencil for identification. Hold the paper by the central clip at each end and bend the sheet in the hands until it takes the form of the letter J, the left hand holding the lower end of the sheet. Now carefully bring this end of the sheet down upon the emulsion, so that the full width of the paper touches the emulsion surface. Slowly lift the left hand while at the same time lowering the right, so that the entire surface of the paper is progressively brought into contact with the emulsion and coated. The wooden strip at the right hand will now be reached. Reverse the motion so that the left hand brings the lower end of the paper back to its original position and every portion of the sheet has been progressively coated twice with the emulsion. Now lift the paper carefully, tilting it at a slight angle so that a portion of the emulsion will drain off the coated sheet into the tray. Reverse the position of the paper, quickly moving it back and forth until the emulsion coating is set, or hold the paper in a current of air produced by an electric fan directing the air over a tray containing cracked ice. In this way the coating of emulsion on the sheet will set very rapidly. When this has been accomplished, suspend the sheet by its wooden strips and clips to dry in a closet or empty room, upon lines of copper wire stretched from side to side of the room. It is needless to say that this room should be well ventilated, free from dust, and that no daylight or artificial light should be allowed access to the sensitive paper while drying.

Drying

All the prepared sheets of paper should be coated in this way. The operation is in itself much simpler than this description. About four or five hours will be required for the drying of the coated sheets. When dry, lay the sheets, coated side uppermost, upon a clean table (in weak ruby light) and remove the strips and their clips. It will be seen that these strips have kept the sheets in good shape during the drying and prevented their curling. Lay each sheet upon a sheet of glass, place a wooden rule or straight-edge upon the ends and trim off the uncoated waste end with a sharp knife. Cut the paper into pieces of the size desired for use and store them, under pressure, for a few hours in a printing-frame fitted with heavy plate glass and a covering of black paper. When flat the paper is ready for use.

Left-over Emulsion Any emulsion left after coating a supply of paper may be poured back into the stoneware crock again for future use. In preparing a second batch of emulsion, the remnant of the first batch can be melted in with the second batch as soon as the latter has been thoroughly mixed and melted. The prepared emulsion, if kept in a cool place and thoroughly protected from light, will keep in good condition for a week or so, the alcohol in the finished emulsion helping in this particular.

After a trial or two along these lines the knack of placing the edge of the paper evenly on the surface of the emulsion will be quickly acquired. No method of brushing or swabbing the sheet with emulsion can equal this hand coating, which in principle resembles machine coating. With a little care and dexterity in handling the coating of emulsion will be quite even and uniform in thickness, without spots or blemishes, such as accompany other methods of coating.

Rough Papers In coating sheets of special rough paper, the motion of the sheet over the emulsion in coating should be slower than that employed in coating smooth papers. This is necessary to give the emulsion time to penetrate into the little hollows and inequalities of the rough surface. A quick motion in coating this sort of paper will give rise to innumerable air-bubbles which, when once formed, are not easily dispersed.

Coating Fabric These remarks apply equally to the coating of linen or canvas. In coating linen, the fabric should first be well washed in hot water to remove any sizing or stiffening material present in the fabric. The linen is then soaked in a hot solution of starch and again wrung out with the hands, this operation being repeated several times to ensure the fabric being completely and uniformly impregnated with the starch sizing. After three wrings, lay the fabric upon a clean cloth and carefully iron it flat with a warm, clean-faced iron. This done, suspend each piece of linen on a line so that it will dry as evenly as possible. The starch mixture used for sizing should be made with boiling water, well stirred, forming a semi-transparent, semi-fluid mixture. No foreign substance whatever, such as borax or wax used by the laundress to give gloss, must be added to this sizing.

To coat this prepared fabric with emulsion, take a clean, thin sheet of white cardboard of suitable size, lay the linen on the cardboard, smooth side uppermost; place the wooden strips and clips at each end as described for the preparation of paper for coating; clamp the linen and cardboard perfectly flat at each end in this way. Prepare as many pieces of fabric as are required in this manner, and proceed to coat with the emulsion in the same way as already described for paper. The thin card backing compels the fabric to take the required shape and form, and at the same time tightens slightly when wetted. The setting of the emulsion and the drying of the coated sheets of fabric is accomplished by the same method as already described in the coating of paper.

Air-bubbles

If air-bubbles should make their appearance during the coating of the fabric, take a two-inch camel's-hair brush set in rubber (which should be ready at hand), dip this into the warm emulsion and quickly brush over the whole sheet of fabric. Now, pass the whole sheet progressively over the emulsion, when it will be found to cover the whole surface without air-bubbles.

The temperature of the drying room for paper or fabric should be kept as uniform as is possible and never allowed to reach freezing point or a low temperature. When the coated fabric is dry, it should be removed from its support and carefully rolled upon a cardboard tube previously covered with several layers of hard-glazed water-proof paper. Trimming the rough edges of coated fabric may be omitted, as these will be required for tacking the sensitive fabric upon the wooden stretcher when the print is to be made.

Development

For the development of prints upon paper or fabric prepared with the emulsion here given, almost any clear-working developer may be used except pyrogallic acid. The following developer, however, will give the best prints under normal conditions: Metol, 40 grains; hydroquinone, 20 grains; sulphite of soda (dry), 140 grains; dissolve the first two items in 20 ounces of warm water, then gradually add the soda sulphite with frequent shaking to prevent its caking. Now dissolve 120 grains carbonate of soda (dry) in 16 ounces of water, and add this to the first solution, making a total bulk of 36 ounces of developer. For ordinary use, take 9 ounces of this developer and add 2 minims of a 10 per cent solution of potassium bromide. With a fairly correct exposure, the development of the print will be completed in about one minute. The prints are then rinsed or slightly washed and fixed in an acid or alum-hypo fixing-bath for ten minutes, after which they should be thoroughly washed in running water for twenty minutes. If the developer becomes sluggish after being used a few times, simply add a few ounces of new developer without the addition of any more bromide solution. Should the paper prints show any trace of degradation in the whites, throw the old developer away and make up a new batch.

When dry the prints, whether on paper or fabric may be trimmed and mounted according to the requirements of the case.

Notes and Comment

The terrible disaster of April 18, at San Francisco, which completely destroyed the business section of the city and wiped out the earthly possessions of so many of its citizens, touched no portion of the community more closely than the photographers. The stories of loss and suffering on every side are pitiable in the extreme, and it is plainly evident that the photographic fraternity all over the country must lend a helping hand to their brothers in distress, to aid them in tiding over their present direful necessities and to reëstablish them in business as quickly as possible.

To this end there was formed in New York, April 20, a committee of prominent photographers and a National Relief Fund was started, to which every photographer in the land is asked to contribute according to his means. Considerable amounts in money and photographic materials have already been sent in to this organization, but there is urgent need for more and larger contributions. The readers of THE PHOTO-MINIATURE are urged to help in this good work, and to help quickly. Every dollar means definite help and relief. Read the appeal here given and send your contribution without delay.

Appeal of the National Relief Fund for California Photographers

At a meeting, in Boston, May 6, 1906, of the California Photographers' Relief Fund Committee, which was inaugurated in New York, April 20, and the National Relief Association for California Photographers, which was started in Boston, April 27, it was resolved and decided that these two committees should act jointly under the title of the *National Relief Fund* *for California Photographers*, and that no photographer in this country, who has the interest of his suffering California brothers at heart, need hesitate to give what he can to either source of appeal, or to both, for the final distribution will be made by the joint committee, to the end that every dollar will go honestly and with strict business care and watchfulness where it is most deserved and needed. As this union of committees is of a national character, all other committees of the country are invited to send their contributions to either treasurer—Joseph Byron, treasurer, 53 West 32d street, New York, N. Y., or Frank R. Barrows, treasurer, 1873 Dorchester Avenue, Boston, Mass.

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Frank R. Barrows, *Treas.*, Boston

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Among the first letters received from San Francisco since the disaster of April 18 was a brief note from Hirsch & Kaiser, the principal dealers in photographic supplies, advising us that they had established new headquarters at 1757 Fillmore Street, and at an early date would be ready for business. By this time Messrs. Hirsch & Kaiser have doubtless secured new stocks and have resumed their former prompt and regular service, covering all the best-known photographic staples, Kodak, Century, Premo and Folmer & Schwing Cameras, American Aristo products, Willis & Clements' platinotype papers, Seed plates, roll films, Autotype carbon tissues, THE PHOTO-MINIATURE series, etc. With all who know this enterprising house, we join in wishing its proprietors new and greater prosperity.

A letter from Fayette J. Clute, who has established temporary headquarters at 416 J St., Sacramento, Cal., tells us that he lost everything except a trunk and some few office effects. Notwithstanding this, the May issues of *Camera Craft* and the *Photographic Exchange* are promised for an early date, and preparations are making for the resumption of all the activities which have made Clute one of the most popular photographic editors of the world. In view of the remarkable service Clute has given through his writings for the various photographic papers, helping thousands of amateurs and professionals month after month, we suggest a general movement for his immediate relief in the shape of short, practical articles, suitable for the photographic papers conducted by him. Many of our readers can supply these, and their receipt will gladden the heart of our friend and materially lighten his anxiety and burden. Send him a helpful, practical paper on any everyday photographic topic; make it sparkle with your actual experience, and brighten it with a carefully chosen example of your best work. Lists of addresses of amateurs and professionals will also be helpful, but, best of all, send him a dollar bill for a yearly subscription to *Camera Craft*.

❧

The modern way in picture-making, as practiced by our leading pictorialists, is to get the picture on a small plate or film and afterwards enlarge it, either the whole of the small negative or any desired portion of it, to such a size as will best convey the effect which it was desired to reproduce. There is a radical difference here as compared with the methods of H. P. Robinson, Colonel Gale and others, which was to use a plate of the size desired in the first instance. The new way is vastly better than the old, opening out many possibilities for picture-making not accessible by the earlier method and very much better and more economical in the cost of material.

The wide distribution of THE PHOTO-MINIATURE hand-books on bromide printing and enlarging and on enlarging negatives has doubtless helped to make the modern way more generally known and appreciated. Another reason for the popularity of the modern way may be seen in the introduction of the Kodak Enlarging Camera, a remarkable and convenient piece of apparatus, thoroughly efficient as an enlarging camera and easily converted into a portrait camera for home work. The reader who has a few little negatives of which he is more than ordinarily proud will do well to give them the advantage of enlargement, either on bromide paper or any other printing paper by means of an enlarged negative. The many advantages of size in picture-making can be properly appreciated only by a practical demonstration. The work is simple and the apparatus comparatively inexpensive, considering its all-round usefulness.

◆

A bundle of extremely interesting information comes to us from the Yunit Chemical Company, Rochester, N. Y. It includes descriptions of the products of the Yunit laboratories, including Yunox post cards, Yunit developers for plates and papers, acid hardeners, intensifiers and blue-print powders. Copies of these may be had on request, and the information is worth sending for.

◆

Taylor, Taylor & Hobson, Ltd., ask us to advise our readers of their removal from the sixth floor of the St. James Building, New York, to the top floor of the same building. The firm now occupies the entire floor and thus has largely increased facilities for handling its rapidly growing business.

◆

We have occasional inquiries from the readers interested in color reproduction asking where a red sensitive dry plate may be obtained, such as the Lovell red plate, now no longer manufactured. We take pleasure in advising that J. Arthur H. Hatt & Co., 12 Spruce street, New York, are prepared to supply such plates and will be glad to send particulars on request. We have received samples of this firm's "Panchromatic" plate and will report on its performance in an early issue.

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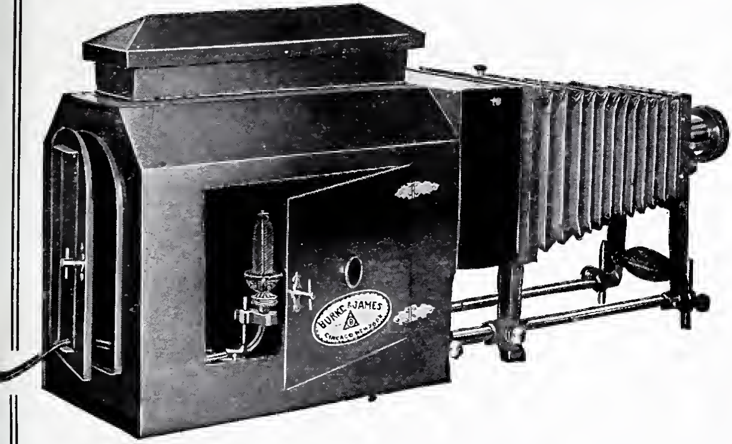

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All our specialties are fully explained in our new booklet, sent free on request. Ask for a copy

"The Art of Negative Making"

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We have made good Lantern Slide Plates for some years, but our introduction last year of

Seed's "Red Label" Lantern Slide Plate for Warm Tones

Fairly surprised us by its instantaneous success. From all over, and especially from the experts, came letters of praise and commendation. Thus

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Your new "Red Label" Lantern Slide Plates are remarkably fine There is no reason why one cannot make a beautiful slide with them, for they are the most willing plates I have ever used—that is to say, they respond to any kind of decent treatment, and give bright, crisp results, or soft, artistic tones, according to the time of exposure. They fix rapidly and a clearing bath is unnecessary; the latitude of exposure is very remarkable, and this one special point makes the plate *par excellence* the one for beginners to use, while experts will enjoy its working qualities and artistic possibilities. Very truly yours,

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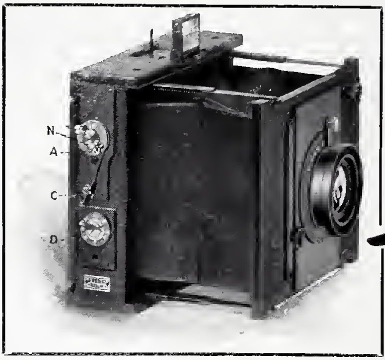

GOERZ TALK

NUMBER ONE

See that
Front
Board?

A COMPARISON

Have you ever noticed that your enlargements and lantern slides have a blurred appearance? That some part of the picture lacks sharpness, and is out of focus?

If you have noticed this, it means that the plane of your lens is not parallel with the plane of your film or plate.

Then look at the front board of your camera. You will find it wobbly, shaky, unstable. When opening the camera the lens never twice falls into the same position. Often it is hopelessly out of plumb, and cannot be set right, try as you may.

That's why your pictures are never sharp, and though they may stand direct printing to some extent, they are worthless for enlargements or lantern-slides where any defect of focus becomes painfully apparent and prohibitive.

Now examine the front board of the Goerz-Anschütz Camera. Notice its ABSOLUTE RIGIDITY. It is supported on all four sides by four steel braces. The lens MUST be plane parallel to the film. AND IT IS.

Hence pictures made with the Goerz-Anschütz Camera will stand enlargements of ten or twelve diameters (144 times in surface) with practically no loss of definition. A wonderful performance for a folding camera.

The Goerz-Anschütz Camera is of small bulk, light weight and unexcelled workmanship. It is equally well adapted to film or to plate. The focusing can be done between each exposure.

The Goerz-Anschütz can be focused at the level of the eye. It takes the pictures as WE SEE THEM, which no other camera does when focusing is done at the height of the chest.

Add to all these advantages that it is fitted with our new improved Focal-Plane Shutter, giving time, bulb exposures, and automatic slow exposures of 5, 4, 3, 2, 1, 1/2, 1/3, 1/4, 1/5, 1/10 second, and fast shutter exposures from 1/10 to 1/1200th of a second, and you will easily understand why it is without exception the finest hand-camera on the market.

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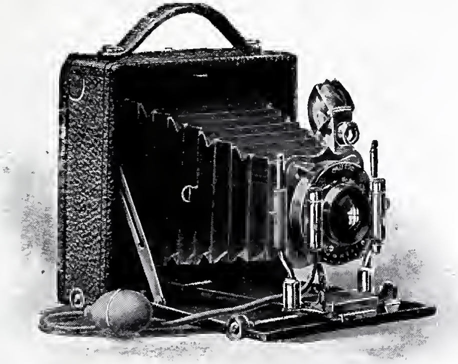

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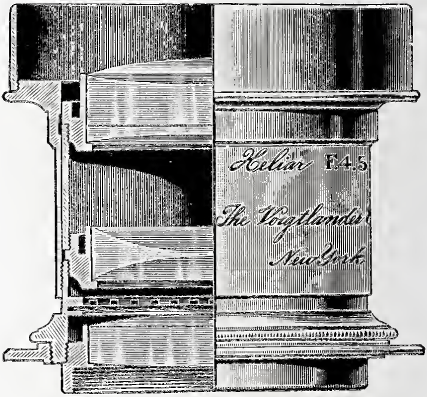

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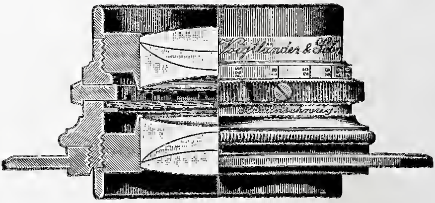

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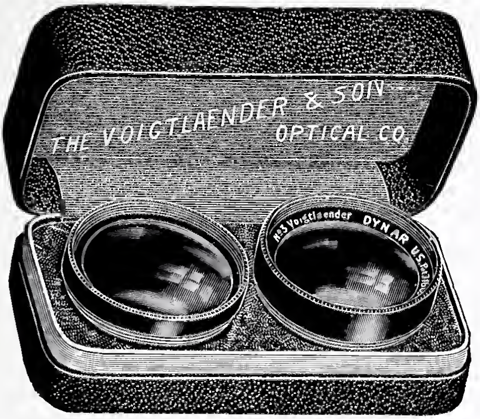

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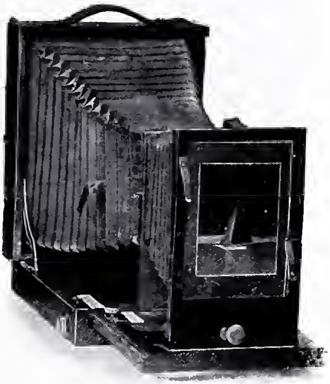
THE KODAK ENLARGING CAMERA



Price $15.00

The Kodak Enlarging Camera does away with the necessity of darkening a room and fitting up a window for the purpose of making a few enlargements from a small negative.

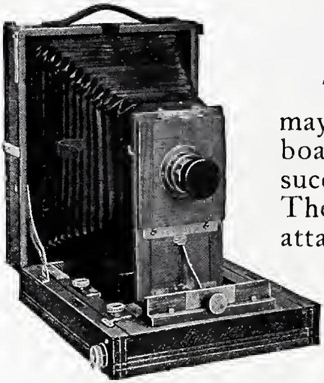
Besides, the instrument folds into a small compass and can be easily carried from place to place, or may be packed in one's trunk or grip. Every part of the camera is made of the best material, handsomely finished and the parts adjusted to that nicety which is essential for perfect photographic results.

The selected negative is placed in the front of the camera, a holder containing a sheet of Bromide paper is clamped in place, then pointing the camera toward the light of a window a short exposure is made. The holder is then carried into a dark room and the print developed and fixed. The whole operation requires but little more time than the making of a Velox print.

With this camera, 6½ x 8½ enlargements may be made from 4 x 5 or 3¼ x 4¼ negatives. Frequently, however, one wishes to use only a portion of a negative or to work from smaller negatives. To provide for this we furnish inside kits (extra) for 5 x 7 and 4 x 5 paper, although one may use the full 6½ by 8½ paper for smaller pictures—the broad white margins often being very desirable.

Eastman Kodak Company

ROCHESTER, N. Y., *The Kodak City*



AS A PORTRAIT CAMERA

The Kodak Enlarging Camera may, by the addition of a lens board and lens, be used most successfully as a portrait camera. The negative carrier (and bellows attached to same) and the lens board are instantly detachable. All that is then required is to slip the extra lens board and lens into position.

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Do., 3½ x 3½	.50
Do., 3¼ x 3½	.50
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Velvet Bromide has the rich, velvety luster that has proved so popular with Velvet Velox.

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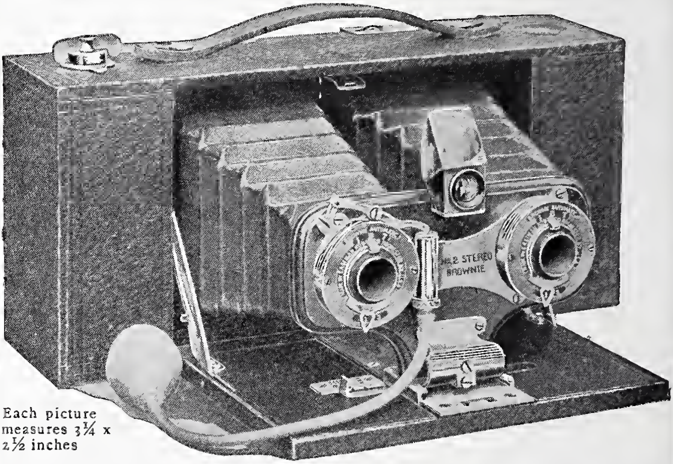

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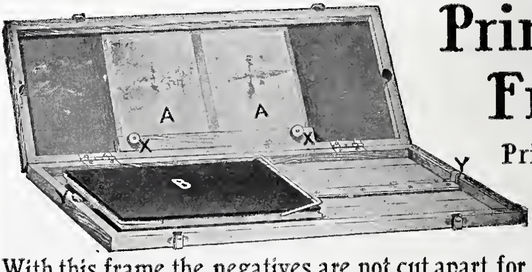

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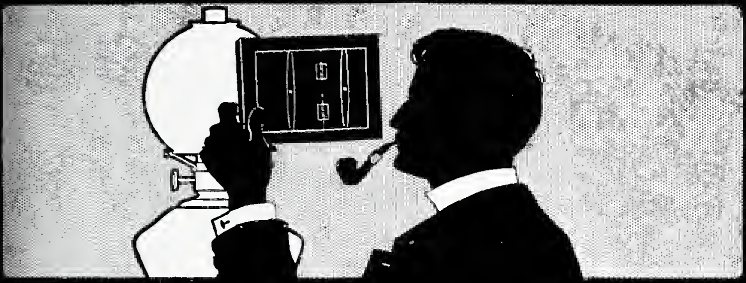

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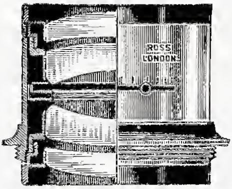

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The British Journal of Photography Says Editorially—

The Multi-speed Shutter It is interesting to see from an article in the "Photographic Monthly" that Mr. Adolphe Abrahams has been experimenting with the "Multi-speed" shutter, and that he has obtained the same surprising effects that other workers have reported. He sums up his experiences by saying that "the focal-plane shutter is beaten in moderately rapid work and hopelessly beaten in exceptionally rapid photography." It seems that the apparent high efficiency and high speed of the "Multi-speed" shutter always surprise those who try it, but we doubt if the mystery is a difficult one to explain if we only remember the way in which the capabilities of the focal-plane shutter have been exaggerated. There is no doubt whatever that the speeds possible with the focal-plane shutter have been greatly overrated. Some time ago we pointed out the conditions that must be fulfilled to attain a speed of one-thousandth of a second with this shutter, and showed that even with an extremely narrow slit such an exposure could only be realized with a blind moving at a rate that is almost incredible considering the mechanism that is available. In diaphragm shutters high speed of movement is more readily attained, especially when, as is the case with the "Multi-speed," the movement is in one direction only and the driving spring is a powerful one. It is these two factors that give the "Multi-speed" such an advantage over the ordinary diaphragm shutter, which has a to-and-fro movement of the shutter blades and driving springs of necessarily limited power. Then, again, in the matter of efficiency the focal-plane shutter has been overrated at high speeds. The smallest slit is necessary for the shortest exposures, and a one-eighth inch slit at a distance of five-eighths of an inch from the plate—not an unusual distance—has an efficiency of only 50 per cent with a lens working at *f*/5. We can increase this low efficiency by using a lens of smaller aperture, but, of course, such a procedure lessens the efficient absolute exposure, and so we lose, instead of gaining anything; if, however, we substitute a diaphragm shutter for the focal-plane one, we can increase both the efficiency and the efficient exposure by simply using a shutter of large diameter, and so a "Multi-speed" shutter of fair size relatively to the lens may, when working at a high speed, give just as much exposure to the plate as a focal-plane shutter working at a rather lower speed.

(From The British Journal of Photography)
Dec. 9. 1910.

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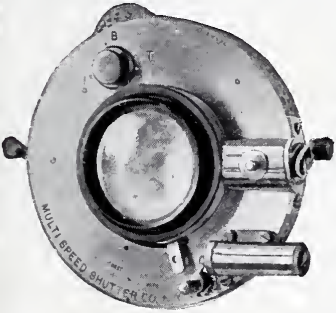

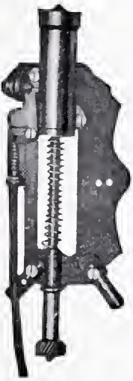

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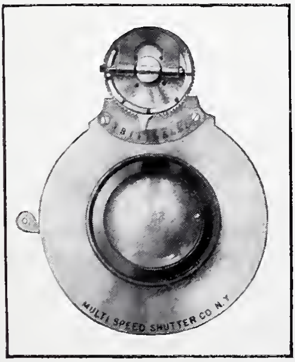

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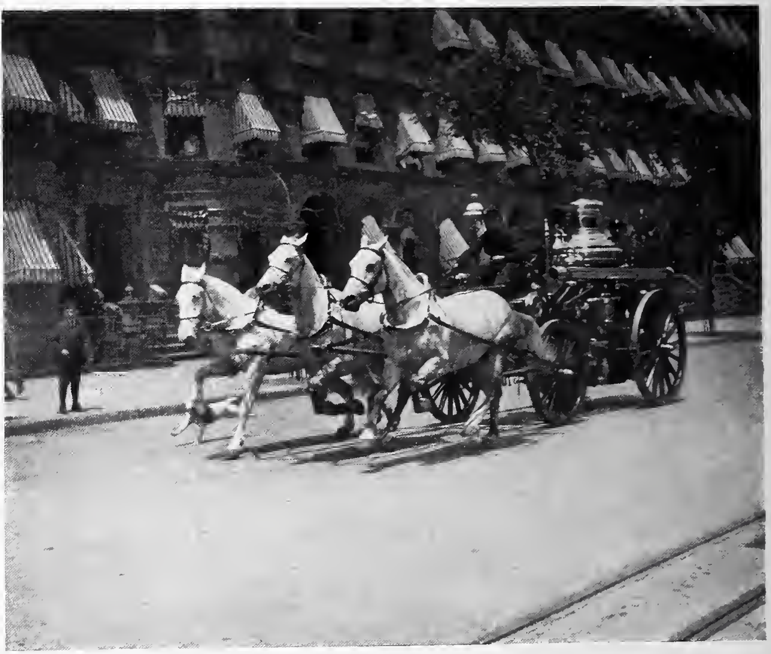

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The Photo-Miniature
A Magazine of Photographic Information
EDITED BY JOHN A. TENNANT

Volume VII JANUARY, 1907 Number 77

Focal-Plane Photography

Focal-plane photography simply means photography with a hand-camera fitted with a focal-plane exposure shutter instead of the usual lens shutter with which every one is familiar. Today, fully 90 per cent of the hand-cameras in use are equipped with lens shutters of one form or another. Just as quickly as photographers become better informed concerning the practical advantages of the focal-plane shutter, it is morally certain that at least 50 per cent of them will use this shutter in preference to any other. The practical result of this change will be that a host of workers will find new interest in photography, wider possibilities and a larger certainty of success in their work with the camera. Here we have the scope and purpose of this number of the PHOTO-MINIATURE.

Let us make no mistake, deluding ourselves by false hopes. Focal-plane photography does not spell *millennium* by any means, but, properly appreciated, it does mean just what I have said: a new interest in photography because of the wider possibilities — the lengthening of the photographic day and season, the capacity for successful work earlier in the morning and later in the evening; for dull and wet days in the early spring and late autumn; for home portraiture, sports and life subjects of all kinds under conditions generally understood to be difficult or impossible except to the expert; and, last but not least, greater certainty of a good negative every time, regardless of conditions. Nor does focal-plane photography mean that the man who knows nothing of photography can gather all these things to himself by simply buying a focal-plane camera at the nearest store. For that man the F. P. K. No. 3 is still the one camera to begin with. But the man already familiar with the use of a hand-camera, and willing to work for his knowledge of the focal-plane shutter, will find therein added pleasure and efficiency in results.

Focal-Plane versus Lens Shutter

A focal-plane shutter consists essentially of a rectangular wooden frame having spring actuated rollers at top and bottom, with a flexible opaque curtain or blind running from one to the other roller. This opaque blind has either a variable opening or slit, or a series of fixed openings or slits of different sizes, the full width of the blind, which works at or very close to the focal plane of the lens, i. e , immediately in front of the sensitive plate or film. The lens shutter, as we know, works between the elements of the lens, or immediately in front of or behind the lens. Obviously, such a shutter opens the lens, permitting the light coming from the subject to pass through to the plate or film, this constituting the exposure. The focal-plane shutter, on the other hand, forms part of the camera body and opens or uncovers the plate or film, having nothing to do with the lens. Hence focal-plane shutters are sometimes called plate shutters.

Since success in negative-making, especially of difficult subjects or under abnormal conditions, depends largely on the amount of light admitted to the plate (through the lens) during that fraction of time which we call the period of exposure, it is plain that an exposure-shutter which directly uncovers the plate itself, leaving the lens free to do its work without impediment or possible obstruction during the whole period of exposure, is better than any shutter which works at or near the lens and may, by lack of accuracy or efficiency in mechanical adjustment or operation, obstruct or curtail the capacity of the lens to pass light through to the plate. In saying this there is no desire to decry the lens shutter, which has, in fact, peculiar advantages in convenience and compactness, as well as practical efficiency within certain well-defined limits. Our manufacturers have had good reasons behind their persistent attempts to perfect the lens shutter, and their equally persistent conservatism in regard to the focal-plane shutter. But the world moves, and the time is ripe for a closer approach to the ideal in this matter of shutters — a fact perhaps more keenly appreciated by European than by American manufacturers. We have "fast" lenses, with all the desirable qualities of the older and less rapid objectives; we have "faster" plates and films, with all the good qualities which characterized the plates of a few years ago; but we have not made proportionate progress in exposure-shutters — in America, at least. Now the focal-plane shutter is being quickly perfected, and promises the "faster" shutter desired, with broader capabilities and a larger efficiency, without any loss of the good points belonging to lens shutters of the familiar type. What is needed most, at this moment, is a wider appreciation of the focal-plane shutter by the acute photographic public.

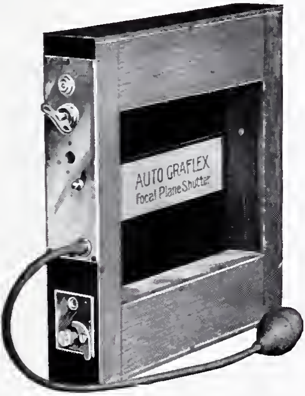


FIG. 1. Auto Graflex shutter

This much being said about an unfamiliar thing, many readers will doubtless want to see a focal-plane shutter, and to know something of its operation, by which to appreciate the large advantages claimed for it. Here the actual seeing is worth pages of description, so the reader is advised to call at the store of a progressive dealer and ask to see a focal-plane shutter and have its working explained. The accompanying illustration, Fig. 1, shows the exterior *Auto Graflex* focal-plane shutter, which may be taken as representative of all modern shutters of this class as sold separately for attachment to cameras. The only other separate shutter at present obtainable in this country is the *Thornton-Pickard* imported by Andrew J. Lloyd & Company, Boston.

Focal-Plane Cameras

Since focal-plane shutters have to be carefully and accurately fitted to the cameras with which they are to be used, the sale of separate shutters is restricted by this inconvenience, and it is usual to buy a focal-plane camera (generally a hand-camera) in which the shutter is built into and forms part of the camera body. There are many varieties of focal-plane cameras, but we can roughly divide them into three typical classes, viz.: the usual folding hand-camera for plates or films, in which the shutter is built in and forms the back part of the box; the extra-compact, collapsible hand-camera, consisting of the shutter, bellows and lens board or front, without a base board or focusing attachment, but with a recessed focusing lens and folding direct vision finder, as seen in the Goerz-Anschutz camera, Figs. 2 and 3 (open with bellows extended for use, and closed for carrying) and the Zeiss Palmos, Fig. 4. The third type, which seems likely to prove most popular because of its greater efficiency, is the reflecting or reflector camera, of which the Auto Graflex in Fig. 5 is representative. Briefly described, this is a rectangular box-camera having a focal-plane shutter at the back and a focusing front or focusing lens, and fitted with a mirror which reflects

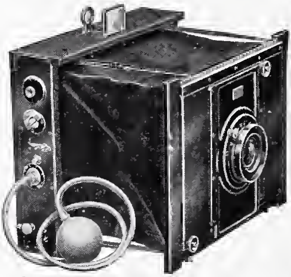


FIG. 2. Goerz-Anschutz

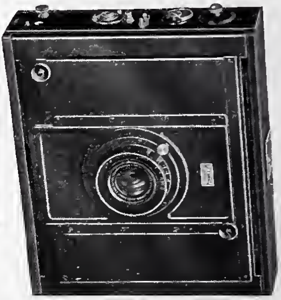


FIG. 3. Goerz-Anschutz

the picture image to a ground glass screen fixed in the top of the box. A hood is provided by means of which the image on the ground glass may be viewed clearly right up to the moment of exposure — this providing the most desirable arrangement for finding and focusing a moving object. When the exposure button or lever is pressed, the mirror swings upward out of the field of the lens, releasing the shutter and so making the exposure. Other cameras of this class obtainable in America are the *Reflex*, the *Auto Graflex, Jr.*, and the *Hales* camera (direct image, without mirror), of which I have not been able to secure illustrations. A survey of the makers' booklets or catalogues will provide these in abundance.

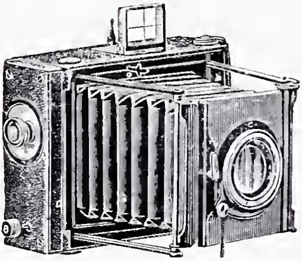


FIG. 4. Zeiss-Palmos

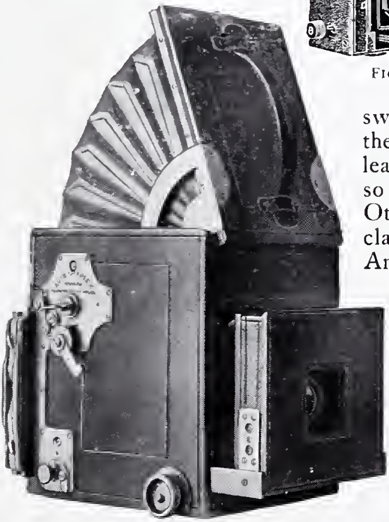


FIG. 5. Auto Graflex fully opened for use

European Cameras

In Europe, where focal-plane photography is more generally appreciated and practiced than in this country, there are perhaps fifty different varieties of these three typical forms, some very much lower and some higher in price than those on the American market. Necessarily, with this variety, there are many differences in capacity, available speeds, construction and workmanship and special features, so that the choice of a focal-plane camera in Europe is a much more difficult matter than on this side of the Atlantic, where we have few varieties closely matched in quality and prices. Those interested in a survey of European focal-plane cameras can get all the necessary information by obtaining the catalogues of the following firms: Newman & Guardia, Ltd., 92 Shaftesbury Ave., London, W.; W. Watson & Sons, 313 High Holborn, London, W. C.; Adams & Co., 26 Charing Cross Road, London, W. C.; Carl Zeiss, Margaret Street, Regent Street, London; Sanders & Crowhurst, 71 Shaftesbury Ave., London, W.; Ross, Ltd., 111 New Bond Street, London, W.; Voigtlander & Son, 12 Charterhouse Street, London, E. C.; The London Stereoscopic Co., 54 Cheapside, London, E. C.; W. Butcher & Sons, Farringdon Ave., London, E. C.; Charles Zimmerman & Co., 10 St. Marys-at-Hill, London, E. C.; Hora & Co., 346 York Road, Wandsworth, London, S. W.; A. E. Staley & Co., 19 Thavie's Inn, Holborn Circus, London, E. C.; Lancaster & Son, Ltd., Birmingham; L. Gaumont & Co., 27 Cecil Court, Charing Cross Road, London, W. C., and Houghton's, Ltd., 89 High Holborn, London, W. C.; City Sale and Exchange, 54 Lime Street, London, E. C.; J. F. Shew & Co., Newman Street, London, W.; and Marion & Co., Ltd., 23 Soho Square, London, W. Making use of this list means some personal trouble and a few international postal cards, but will bring the reader more information about focal-plane cameras than can be obtained in any other way, hence the list is given, not for advertisement, but for the benefit of the reader. It includes the agents for German and French, as well as British cameras and so offers data for a fairly complete survey of the field. At the end of the survey the reader will doubtless perceive that he can purchase, on this side of the Atlantic, a camera well adapted to his requirements, and it must not be overlooked that cameras made for European markets rarely give unmixed satisfaction to the American purchaser. To this rule, of course, there are exceptions.

American Cameras

Focal-plane cameras are made or imported by the following American firms, who will, doubtless, send descriptive literature on request: The Folmer & Schwing Mfg. Co., Rochester, N. Y.; Borsum Camera Co., Newark, N. J.; Goerz American Opt. Co., New York; G. Gennert, New York; Hales Camera Co., Ridgewood, N. J.; Hall Camera Co., New York; and Miles Greenwood, Melrose, Mass. It is said that the Eastman Kodak Co. will shortly introduce a roll film camera fitted for focal-plane work, but, of this I have no authoritative information. My space being already overtaxed, I am obliged to put aside any idea of describing the cameras of these makers, so that the reader must fill out his information in this regard by a diligent study of the manufacturers' booklets and catalogues.

How to Choose

In the choice of a focal-plane camera, the most important point is practical efficiency—the capacity to give results, and he is most wise who is willing to sacrifice every other consideration to gain this chief virtue. But since some are swayed by convenience of handling, others by compactness and portability, and others again by the grim question of cost, a few words about the differences in cameras and focal-plane shutters may be helpful.

Reflector Cameras

First, as to cameras: there can be no question but that the reflector type is the most efficient. Its construction insures that perfect rigidity and parallelism of front and back (lens and plate) essential to sharp definition. Its reflecting mirror, horizontal ground-glass and focusing hood provide an ideal means of focusing a moving object right up to the moment of exposure, together with a full-size finder giving the subject right side up—not inverted, just as it will appear in the negative. Such cameras are necessarily bulky and heavy, but surprisingly "handy" in operation to any one accustomed to the lighter and more fragile construction of the average folding hand-camera. They will also stand an amount of heavy wear and rough treatment which would be fatal to the average folding camera. American cameras of this class are the Auto Graflex series made by the Folmer & Schwing Co., and the Reflex, made by the Borsum Camera Co. A special model which gives a direct, visible image, right side up, until exposure, without either mirror or focusing glass is the Hales camera, made by the Hales Camera Co.

Direct Vision Cameras

In compactness and portability, the collapsible, direct vision finder cameras so popular in Germany make a strong bid for popularity. These consist simply of a focal-plane shutter, an easily-folding bellows, and a front board carrying a recessed lens in focusing mount. Considering their lightness of construction, these models are wonderfully rigid when extended, this being secured by ingenious sliding stays. Some European models are almost wholly made of metal and are heavy and cold in the hands, especially in winter time. The use of the direct vision finder necessitates a holding position about at the level of the eye. Some workers claim this advantageous, but it requires considerable holding drill to keep the camera perfectly steady at the moment of exposure. The American models of this type are the Goerz-Anschutz, the Zeiss Palmos and the Speedway.

Folding Cameras

For those who are accustomed to the folding hand-camera and prefer this type, the market offers several models fitted with focal-plane shutters, such as the Graphic series made by Folmer & Schwing. They offer the advantage of abundant bellows extension, permitting the use of long-focus lenses, desirable in some branches of work, or lenses of different focal lengths. Most cameras of this class are made for the use of plates or cut-films only, but one model which takes plates, cut-films or roll-films at will, without special attachments, deserves special mention. This is the new Deft camera (Fig. 6) introduced by Watson & Sons, London, and obtainable in this country from Miles Greenwood. Despite the advantages and superiority of the other types, it is doubtless in this form, along the line of least resistance, that the use of the focal-plane shutter will most quickly reach the popularity it deserves.

The Shutter In all focal-plane cameras, however, the shutter is the feature of prime interest and importance. When buying such a camera, therefore, see that a goodly proportion of the price paid goes to the shutter, covering sound construction, good workmanship and the best of materials. Wooden rollers, metal springs and gearing, and a linen curtain or blind broken by openings or slits—the combining of such materials into an instrument which has to stand considerable wear and strain, frequent adjustment, powerful driving and sudden stoppage calls for a lot of careful handwork. In this respect a focal-plane shutter must always cost more to manufacture than a good lens shutter. In the earlier focal-plane shutters the curtain or blind consisted of a single strip of opaque linen with an adjustable (variable) opening or slit about the middle. The size of this aperture was varied by means of a cord or series of links, and the adjustment necessitated getting at the shutter itself from inside—a tedious and troublesome operation. Now-a-days this adjustment of the slit is done from the outside by means of a milled head, a register or index marked with figures showing the size of the slit or opening in position at any moment. The speed at which this slit passes across the plate is controlled by a tension spring, operated by means of a second milled head on the outside of the shutter or camera. Obviously, the number of different exposures possible depends on the number of apertures available and the different speed-tensions arranged for. This feature varies largely in different shutters. Thus, the new Goerz-Anschutz shutter has 10 tensions and 9 curtain apertures, thus providing for 90 different speeds or expo-

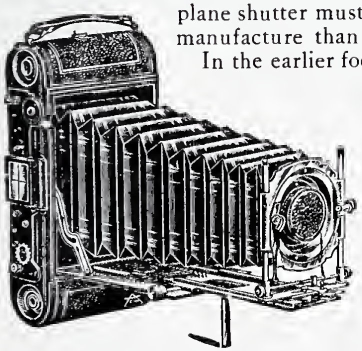


FIG. 6. The Deft Camera

sures, ranging from $\frac{1}{10}$ to $\frac{1}{1200}$ second, apart from auto bulb-exposures from ½ to 5 seconds and "time" exposures. The Reflex camera has 8 tensions and gives a long range of speeds from $\frac{1}{10}$ to $\frac{1}{2000}$ second, with a retarding fan permitting exposures up to 3 seconds. The Auto Graflex (regular) has 6 tensions and 5 apertures, giving speeds from $\frac{1}{10}$ to $\frac{1}{1000}$ second and "time" exposures. Still later forms, designed for simplicity in operation and a narrower range of work, abandon the variable tension and provide for a given number of speeds by a series of openings of different sizes, working at a fixed (invariable) tension, such as the Auto Graflex, Jr. The use of a curtain having a series of fixed slits or openings, instead of the variable (adjustable) slit is comparatively recent and seems to make for simplicity and greater certainty in operation. This improvement is one of the principal features of the Auto Graflex shutter (Fig. 7) and is said to fulfil its purpose perfectly, meeting all the requirements. The curtain of the Goerz-Anschutz shutter is made in two sections; the upper section having a fixed slit of large size for time- and bulb-exposures, the lower section having an adjustable narrow opening for instantaneous exposures. The two portions of the blind are kept separate in their action by a device controlled by means of a button on the outside of the camera. It is by means of this double blind that this camera secures its peculiarly wide range of available speeds. In some focal-plane shutters the blind is made two-fold in thickness to obviate pinholes and similar defects arising from wear and tear in constant use. The Reflex upper curtain

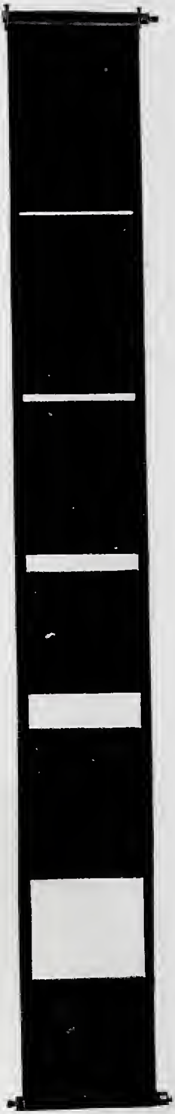


FIG. 7. Curtain of Graflex Shutter

section is steel lined, as flexible as thin silk; other shutters are reinforced with thin steel bands.

Self-Capping Shutters

Until very recently it was essential to cover the plate or cap the lens before setting a focal-plane shutter ready for exposure. Now many shutters are provided with a self-capping device, so that the plate or film is always protected during the setting of the shutter. This self-capping feature is especially desirable in cameras using roll films, but is unnecessary in reflector cameras as the mirror completely protects the plate except at the moment of exposure.

No Best Shutter

Considering all these differences and modifications, one peculiar to this shutter, another to that, some of them of proven value and others still in the experimental stage, it is practically impossible to pronounce any one shutter to be better than all the others. Every change made has some end in view, and all testify to the fact that the ideal focal-plane shutter is yet to come. Some shutters are constructed for simplicity of manipulation, others to give a few speeds with absolute certainty, others, again, to meet the desire for a wide range of speeds and capacities, and so on. To go into the different variations and attempt to show their significance and comparative worth would require endless experiment and a bulky volume. The common-sense way is to buy from a reliable firm, pay a price which will ensure a good article, and then to experiment carefully with the data furnished by the manufacturer until you *know how* to operate the shutter chosen, what it will do, and what it will not do. All the focal-plane shutters I have examined or used have amply fulfilled their makers' claims and covered my requirements. Personal preference must decide the choice among them. The prime necessity in taking up focal-plane photography is to know your camera and shutter, to be thoroughly familiar with its manipulation, to drill yourself in its proper use: how to hold it without movement or vibration, how to adjust and set the shutter quickly and with absolute certainty, how to press the exposure-lever without an instinctive tightening of the grasp, and so on. This means a surprising amount of practice before going out with plates or films for actual work. Sit down at home, in comfort, and learn all the motions of the camera and shutter, and the proper order in which the different operations need attention. In this getting acquainted and a close following of the working instructions sent out with the camera or shutter is the quickest way to get proficiency in handling the instrument. Nine-tenths of the failures in the first few weeks of focal-plane work can be traced directly to lack of familiarity with the proper manipulation of the camera. No amount of information here can help because of the great differences among the various instruments and the modifications continually introduced by manufacturers. Outdoors, however, facing the subject, nothing can replace an actual familiarity with the proper handling of the camera and its peculiar points.

The Efficiency of the Focal-Plane Shutter

BY JULIUS MARTIN

In photographing moving objects, the allowable displacement of the image, i. e., its movement on the plate during exposure, is $\frac{1}{100}$ of an inch. This necessitates extremely short exposures, with the consequent difficulty of admitting sufficient light to the plate to give a developable image. Under such conditions the efficiency of the exposure shutter is as vital a detail as the intensity or rapidity of the lens.

As most photographers know, all exposure shutters may be roughly divided into two classes: (1) those in which the moving parts are metal or hard rubber plates which pass across the lens or, in the form of sections open from and close to the centre of the lens, and (2) those in which the moving part is a flexible opaque curtain or blind on rollers, with fixed or variable openings, which expose the plate as the blind passes the lens or plate according to the location of the shutter.

Shutters of the first class are known as lens shutters, usually forming part of the lens mount and working either between the elements of the lens or immediately in front of the objective. They give exposures ranging from "time" to $\frac{1}{100}$ second, a few special varieties ranging as high as $\frac{1}{300}$ second, and one (not yet in the market) ranging as high as $\frac{1}{800}$ second. The best shutters of the roller-blind class are known as focal-plane shutters, because the blind and its apertures work almost in the focal plane of the lens, i. e., immediately in front of the sensitive plate or film. By reason of their construction and working position, focal-plane shutters permit of much higher speeds (shorter exposures) than the average lens shutter, ranging from "time" to $\frac{1}{1800}$ second and even higher. In addition to this capacity for extremely short exposures, focal-plane shutters possess the great advantage of maximum possible efficiency in transmitting the light admitted by the lens to the sensitive plate. Let us see what is meant by this greater efficiency.

"Efficiency in an exposure shutter refers to the time the shutter allows the lens to be fully open, as compared with the time during which the shutter is opening and closing and, therefore, covering part of the lens" (Bayley: *The Complete Photographer*). The ideal shutter may be defined as one which occupies no time in opening or closing, but allows the whole of the light passing through the lens to fall on the plate during the whole period of the exposure. Failing this, the shutter which passes the greatest amount of the light admitted by the lens in a given time is the most efficient.

Taking the case of a lens used at full aperture without a shutter, as seen in Fig. 8, it is obvious that all the light passing the lens at once reaches the whole of the sensitive plate or film. We have here full efficiency, representing 100 per cent.

In the case of a lens used at its full aperture with a between-lens or diaphragm shutter, as seen in Fig. 9, the shutter opens from the center and when it has reached its maximum opening, the leaves or sections reverse in their motion and return to the closed position. It is obvious that a portion of the exposure period is here occupied in opening and closing, during which motions the shutter acts as a diaphragm varying in size, and that only at the moment the shutter is open to the fullest extent does all the light admitted by the lens pass to the plate. The vertical lines in Fig. 9 illustrate this, showing the lens closed, gradually opening, attaining the maximum opening and then gradually closing again. It is seen that this type of shutter increases in efficiency as the size of the lens aperture is decreased, since the period when the lens aperture is full open is thus prolonged. It is also plain that this type of shutter is less efficient when a very short exposure is given with a large lens aperture—exactly the reverse of what is required in photographing moving objects.

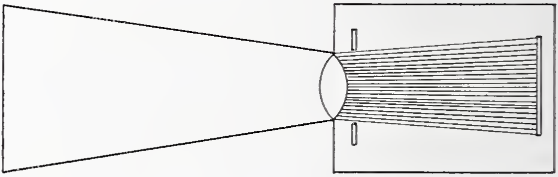


Fig. 8

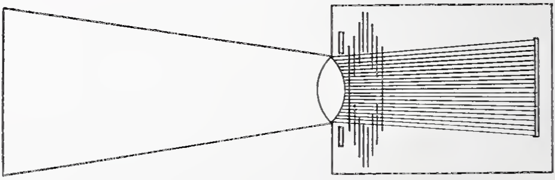


Fig. 9

Finally, in the case of a lens used at its full aperture with a focal-plane shutter, as seen in Fig. 10, the opening in the blind travels across the plate in a rapid succession of streaks, passing to the portions of the plate thus uncovered all the light admitted by the lens during the whole of the exposure period, the movement of the opening in the blind being uniform, in one direction, and the size of the opening remaining unaltered during the exposure.

From this we perceive that the efficiency of the focal-plane shutter is the maximum possible efficiency of 100 per cent (Fig. 11), while the efficiency of the diaphragm or lens shutter is variable, according to the time occupied in opening and closing, and also according to the lens aperture used and the total duration of the exposure (Fig. 12).

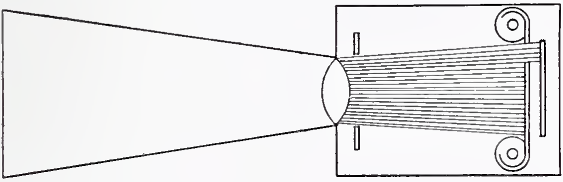


FIG. 10

Broadly put, this greater efficiency of the focal-plane shutter is expressed by saying that, under identical conditions and in a given time, it passes three times as much light to the plate as is passed by the average between-lens shutter, i. e., an exposure of $\frac{1}{100}$ second with a focal-plane shutter will give as good a negative as an exposure of $\frac{1}{35}$ of a second with a lens-shutter.

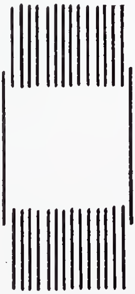


FIG. 11

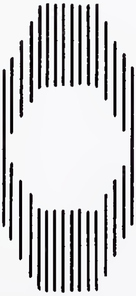


FIG. 12

On the Application of Focal-Plane Shutters

BY L. J. R. HOLST

The ability of focal-plane shutters to give exposures of very short duration has caused these shutters to be used almost exclusively for high-speed work, and to be quite overlooked when an exposure of longer than one-hundredth of a second is required.

The object of this article is to demonstrate that focal-plane shutters should also be used for the longer exposures and will produce *better* results than can be obtained with lens shutters on any exposure ranging from say $\frac{1}{100}$ second to one second.

Beyond this contention, we need only consider the essential difference between lens shutters and focal-plane shutters, which may also be called plate shutters.

The first-mentioned class of shutters opens and closes the *lens*, the latter class of shutters opens and closes the *plate*, leaving the lens open all the time, and in that fact lies the cause of its superiority. When a plate shutter is adjusted to give an exposure of one-tenth of a second, every part of the plate has received during that entire period a light-impression equal to the full intensity of the lens. When a *lens* shutter has been adjusted to produce an exposure of equal duration, the full intensity of the lens has acted only during a fraction of the total time of exposure, due to the fact that the shutter has absorbed time in reaching its full opening from the closed position, and vice versa.

There are many shutters in which the blades reach the full open position exactly at the middle of the period of exposure, after which they immediately begin to close. Such shutters pass exactly one-half of the light which the plate shutter would have admitted, and consequently would require an exposure twice as long as that needed with the plate shutter to produce an equal impression on the plate. In this instance the lens shutter works with a light-efficiency of only 50 per cent, and, although this is the minimum efficiency with which a lens shutter can work, many such shutters are in daily use, principally on studio cameras, and lead the user to believe his lens to be slow, whereas the lack of efficiency in the shutter is never suspected so long as its mechanical action keeps in order. The plate shutter, on the contrary, admitting the full light intensity during the entire exposure, works with 100 per cent light efficiency, on which result, of course, no improvement is possible.

When we further consider that in all instances where the longer instantaneous exposures can be given, there is of necessity little or no motion in the object to be photographed, and that consequently the only possible theoretical objection against plate shutters, viz.: the distortion caused by the successive exposure of the various parts of the plate, is entirely obviated, it becomes clear that for the slower exposure these shutters are theoretically ideal. It remains, then, only to examine the various mechanical features of these shutters as compared to the mechanical properties of lens shutters in order to arrive at a conclusion about their actual value in the every-day practice of photography.

In this respect, we observe, first of all, that the plate shutter forms a part of the camera, which may thus be equipped with a number of different lenses, all of which can be properly judged, compared and used in point of speed, as the influence of different shutter efficiencies is entirely eliminated.

Many focal-plane shutters now on the market are mounted in separate frames, attached to the cameras, and thus increase the bulk of the outfit. This objection is obviated in box-cameras and can be obviated equally well in folding view-cameras, by building the shutter as a permanent part of the back, instead of as a detachable device. This latter construction will probably find favor with many photographers as soon as they begin to recognize the value of plate shutters for slow as well as for fast exposures, and as soon as the manufacturers will make these shutters to work slow as well as fast.

The necessity of capping the lens, or otherwise protecting the sensitive surface when setting a focal-plane shutter, must rightfully be considered as a hindrance to their universal application to view-cameras, and more particularly to such of these as are used with film packs or roll films. We may safely predict that this consideration will induce the designers of shutters to apply their inventive powers toward the production of self-capping or safety plate shutters. [This has since been accomplished, and self-capping focal-plane shutters are now readily obtainable. EDITOR.] If, in addition to this feature, they will also be arranged to give besides fast and slow, instantaneous exposure, also bulb and time exposures, we shall possess a practical, universal exposure shutter which will very seriously compete with lens shutters for public favor.

Advantages of the Focal-Plane Shutter for Other Than High-Speed Work

The widespread impression that the focal-plane shutter is for the expert only, and is used by him only for high-speed work, has doubtless arisen from the fact that most photographs we see of objects moving at high-speed are labeled: "Made with the —— focal-plane shutter, exposure $\frac{1}{800}$ second," or words to that effect. Perhaps the high price and comparative scarcity of focal-plane shutters has also been a factor in keeping the amateur from inquiring into this form of shutter and its capacities for his ordinary requirements. Whatever the cause, the impression is emphatically erroneous. It is true that the focal-plane shutter is so constructed that it permits of extremely short exposures, such as are beyond the capacities of the ordinary lens shutter, and that it gives results in photographing rapidly moving objects which cannot be obtained with lens shutters. But there is no need to confine the focal plane shutter to high-speed photography exclusively, any more than it would be reasonable to keep a fast lens only for occasions where no other lens will do the work. The fact of the matter is that the focal-plane shutter in its newer forms, self-capping, with a series of fixed apertures and the device permitting accurately regulated slow exposures, comes nearer to the universal exposure shutter for all kinds of photography, indoors and out, than any other form obtainable. To say this is not to decry the convenience and advantages peculiar to the lens shutter—not at all, but is simply to call attention to a convenience which, especially in America, has been too long overlooked and neglected alike by manufacturers and users.

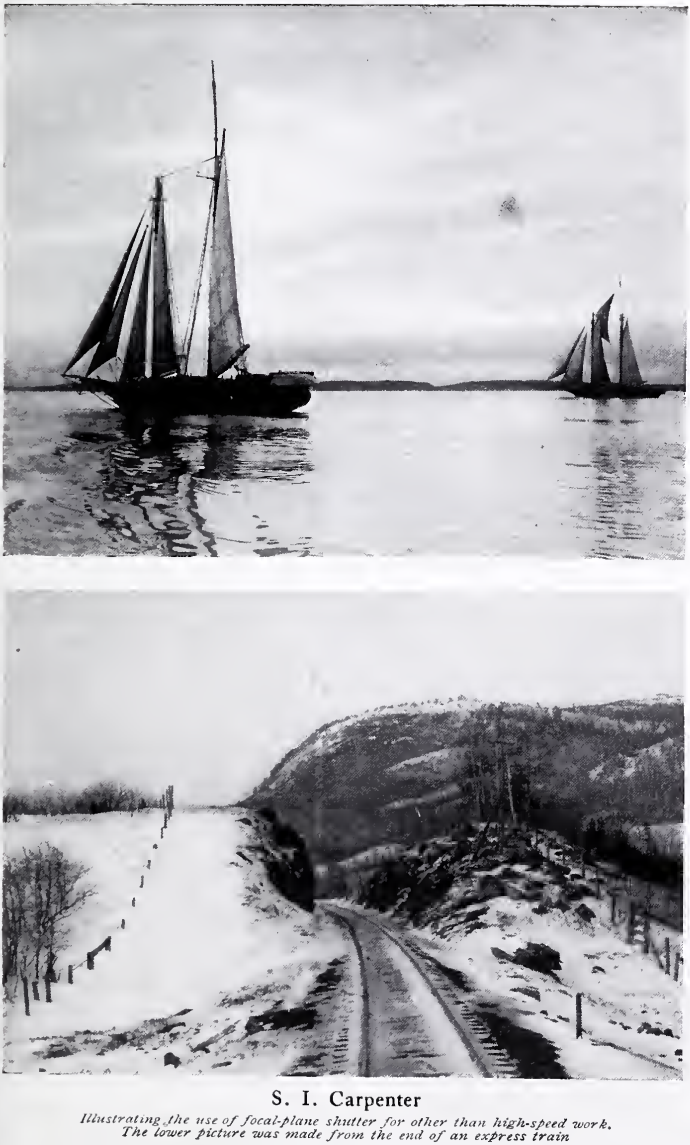
Here and there, with increasing frequency, one comes across an amateur who has for years used the focal-plane shutter for all his work, disregarding all other forms because of the all-round convenience and efficiency of the focal-plane type. From one of these, Mr. S. I. Carpenter, whose work is well known and esteemed among New England amateurs, we have the following testimony on this point:

Carpenter's Experience

Practically all my 4 x 5 work has been made with a focal-plane shutter, and I have a thousand or more negatives, including every class of work, landscape, ships, country-fairs, clouds, in fact, every kind of photography where, as an amateur, I have found chance to use the camera. Some of my work has been done at the higher speeds obtainable with this shutter, but not a large proportion, as I am a believer in the wide usefulness of this shutter for ordinary hand-camera work where the high speeds are rarely required. To my mind, the focal-plane shutter in design, in its close proximity to the plate, its great efficiency permitting the use of small stops, thus giving depth of field, and with its covering the plate up to the moment of exposure, is far better adapted to the general run of amateur work and will give a bigger percentage of good negatives under widely varying conditions than most amateurs are aware of or will admit.

Avoid the Narrow Opening

The trouble with most amateurs who buy a focal-plane shutter is that they do not sufficiently grasp the possibilities it offers in its larger efficiency and larger openings. They hear so much from the manufacturers of the wonderful things done with the small openings or slits and high tension that they do not stop to think or work out the far more wonderful capacities put into their hands by the larger openings. I never could understand why the makers of focal-plane shutters should so continually harp on exposures of $\frac{1}{1000}$ second or show, as examples of the work of the shutter, pictures which are possible only on rare occasions, and under the best conditions, losing sight of the adaptability of the shutter for all kinds of photography when once the use of wide openings is understood.



S. I. Carpenter

Illustrating the use of focal-plane shutter for other than high-speed work. The lower picture was made from the end of an express train

High Tension Fallacies

My experience has shown that there is little necessity for so frequent a use of the higher speeds with the consequent use of high tensions and narrow openings, unless one's work is confined to photographing flying birds and express trains at direct right angles to the lens. My notion is to use the slowest permissible exposure. It gives better negatives, less failures and very much more satisfaction. I have photographs of many fast-moving objects, even birds and trains—good negatives, with detail and desirable printing density, made with exposures much under $\frac{1}{1000}$ second. In fact, I am inclined to think that from $\frac{1}{300}$ to $\frac{1}{500}$ second will accomplish all that anyone can desire to do except under the most abnormal conditions.

So, when I first got my focal-plane shutter, I opened up the narrow slot from $\frac{1}{8}$ to $\frac{3}{8}$ inch and used this aperture with the old tension scale. This means that when the shutter is set for $\frac{1}{400}$ second I get an exposure of not much over $\frac{1}{100}$ second; when the shutter is set for $\frac{1}{1000}$ second, my exposure is between $\frac{1}{200}$ and $\frac{1}{300}$ second, and so on. These speeds have proved sufficient for most fast-moving subjects. Thus using the shutter set for $\frac{1}{600}$ second, one gets as full an exposure as is given by the best lens-shutter working at its top speed; using it set at $\frac{1}{200}$ second, I get good negatives in dull or rainy weather, and so on.

The two surf pictures I am sending were made in a heavy rain-storm with the $\frac{3}{8}$ inch aperture and an exposure of $\frac{1}{200}$ second. As you will see, they are good negatives, sufficiently sharp and fully exposed, while conveying the sense of the sea under the prevailing conditions. I am also enclosing prints from negatives made from fast-moving trains, a harbor scene, hen and chickens feeding, and a few landscapes. (Some of these are reproduced herein.—EDITOR.)

The Man behind the Shutter

To do successful work with rapid lenses and a focal-plane shutter, the operator must combine patience with quickness to seize the most favorable moment for his exposure and, above everything else, the ability to relax his hold on his camera even when under the stress of excitement. By this I mean the ability to hold the camera loosely but securely in the hand. Many focal-plane exposures are failures because of the unconscious tightening of the muscles of the hand just at the moment of exposure. This relaxes with a snap at the end of the exposure and acts exactly as the vibration of the tripod acts in stand work, giving a blurred image. Much of my best work in moving subjects has been done with the camera held in two fingers by my side, level with the hips or knees, the bulb in the palm of the same hand ready for exposure. In this position, of course, care must be taken to provide for the increased amount of foreground. The finder on my camera has part of the opening covered, showing a square much less than what the ground-glass would show. I get what I want within that square and so am always sure that the object aimed at is well on the plate.

Development

My experience tells me that there is quite as much art in developing focal-plane exposures as there is in the exposures themselves. In this I am a believer in individual methods, knowing one's chemicals and their action separately and in combination and how to use them for the result to be gained. Many focal-plane failures I have seen have been due to incomplete development, to the use of developers unsuited to the conditions of exposure, and, above all, to the tendency of the operator to hasten development by any and every means, in order to find out what success he had. In focal-plane development time and patience are essential.

Claudy's Argument

Mr. C. H. Claudy, who, as a newspaper photographer, has had ample opportunity to test the all-round usefulness of the focal-plane shutter for ordinary as well as special branches of work, bases his argument on the efficiency of the focal-plane shutter, and what he has to say is very much to the point. I quote:

> The focal-plane shutter is, essentially, a curtain or blind passing from top to bottom close to the plate, with an aperture its full width which lets the light strike the plate as it passes before the surface. The greater the width of this aperture, the more light gets in with a given

speed of curtain—the smaller this aperture, the less light. If the curtain passes a slit two inches wide across a plate in a tenth of a second, then, if the slit be reduced to one inch, the exposure is half the first one, or twice as fast, and so on.

Efficiency The great advantage of the curtain shutter as an illuminator comes from the fact that the lens is left uncapped all the time — there is no fraction of the exposure wasted in opening and closing the shutter as in the ordinary type. And the faster the focal-plane shutter is operated, the more efficient it is, in comparison with the between-the-lens shutter, drop, or behind-the-lens curtain shutter for obvious reasons. A between-the-lens shutter operating at $\frac{1}{10}$ second may occupy one-tenth of the total exposure time in opening and one-tenth in closing, leaving a real efficiency of 80 per cent of its indicated time. The focal-plane shutter for the same exposure has a maximum efficiency of 100 per cent of its time of working,—since the lens passes light to the plate from the instant of starting to the instant of stopping the exposure, and this through the entire lens aperture employed. But when we come to a between-the-lens shutter working in $\frac{1}{100}$ of a second, we find that the proportion of the total exposure time consumed in opening and closing is far greater, reducing the real efficiency of the shutter to 40 per cent of the total exposure time and even lower. Thus, a plate which receives a full exposure with the between-the-lens shutter at $\frac{1}{100}$ second marked speed would get the same exposure, according to the figures just mentioned, at $\frac{1}{250}$ second with the focal-plane shutter.

Examples Here we come to a great advantage of this type of instrument for other than speed work. If the subject is one which does not demand so high a speed as $\frac{1}{250}$ second, the speed may be reduced to the necessary value and the exposure kept the same by stopping down the lens,—often a decided advantage for work other than pictorial, and especially if a lens of fairly long focus is being used where the depth of focus is necessarily small

Again, there are numberless occasions where the difference between the quickest of bulb exposures,—

perhaps $\frac{1}{5}$ second, and a slow focal-plane exposure, say $\frac{1}{12}$ second, may make all the difference between success and failure. Portraits out-of-doors where foliage moves, babies and animals, who (and which) move slowly or only a little, may blur a quick bulb exposure but are motionless to the slightly quicker focal-plane exposure, which yet admits as much light as the bulb exposures and gives as good a negative.

Probably the greatest advantage of the focal-plane shutter, however, outside of its capability for photographing objects moving at great speeds, lies in its use on a hand-camera for usual hand-camera work. Every one who does street work, touring photographs or ordinary "snapshotting" at home and abroad, knows that there is a continual endeavor to strike a happy medium between an exposure swift enough to stop the motion of the subject and slow enough to give enough exposure for a plate, which, if not so good as wanted, is yet good enough to "doctor" afterwards. Now, with a reasonably good lens,—say one working at *f*/6 or faster,—the focal-plane shutter will take almost anything in apparently impossible lights. I have known of good, printable negatives being made in an actual $\frac{1}{1200}$ of a second, at five in the evening in April. Of course, the lens was fast and the operator expert. But the vast majority of photographers do not own a selection of fast lenses. In the focal-plane shutter they have a tool, which, in effect, adds from 10 to 100 per cent to the efficiency of their rapid rectilinear lens. We all know the fate of the plate exposed in the shade outdoors, if the snap had to be quick enough to stop a man walking—soot and whitewash. But the focal-plane shutter, same lens and same stop, same plate and same indicated time, will give a fully-timed negative under similar conditions. The focal-plane shutter makes your lens act as a faster lens would act with a between-the-lens shutter such as you now use. And, as the cost of the focal-plane shutter is much less than that of a high-grade anastigmat, its economy is obvious. Besides, a focal-plane shutter can be used with any number of lenses,—only one is needed for any one camera, a further economy

Percy M. Reese

Upper: The Diver—R. R. lens, f/16, exposure 1-1200th sec. July
Lower: Taken from end of street car, R. R. lens, f/16, exposure 1-250th sec.

Operation Reliability

Then, there is the very important question of ease of operation and reliability. It must be confessed that it is not so easy to wind up a curtain, see that a tension screw is set right and the curtain aperture as you want it as it is to set a Volute or Sector or, in the case of an automatic shutter, to press the bulb. On the other hand, it is actually very little trouble to adjust the focal-plane shutter, and the benefits resulting from its use are so out of proportion to the small extra trouble involved that it is hardly worth noting at all. In the matter of reliability, the focal-plane shutter has the advantage over the other types, reliable as many of these are. The small between-the-lens shutter has been made with its parts as light and as small as possible, in order to insure compactness and portability. The focal-plane shutter, on the contrary, is constructed of few and comparatively large parts and is so made that there is almost nothing to get out of order. The most fruitful source of trouble in the between-the-lens shutter is grit in the mechanism or dampness in the dash-pot. The focal-plane shutter has no dash-pot and it would take a good deal of dirt and grit to clog its action.

Recapitulation

To sum up, then, the focal-plane shutter offers great advantages for other than high-speed photography, because, (1) it admits of the entire focal value of the lens being used at all times; (2) it permits of the same effective exposure being made with a smaller stop and consequent gain of depth, than is possible with other styles of shutter; (3) only one shutter is required for any number of lenses; (4) it adds, effectively if not actually, to the speed of an otherwise slow lens, and (5) it is more durable and subject to less disorders than between-the-lens shutters. Finally, in its possession you have a tool which will take pictures of objects moving so rapidly that any other shutter produces only a blurred image.

More Experiences by Reese

Writing of a European trip, Mr. Percy M. Reese, of Baltimore, gives his experiences as follows: I took with me a reversible back, long focus 4 x 5 camera, equipped with a Goerz lens and an iris diaphragm shutter which had been tested and re-corrected until it gave accurately and invariably the speeds marked on the dial, up to and including $\frac{1}{100}$ second at the highest speed. This is sufficiently fast for street work at *f*/8 and gives full exposure with Eastman film in our bright sunlight. After leaving Italy, the light seemed so much weaker that I was obliged to use slower speeds and

Percy M. Reese

Taken after sunset, in May. Goerz lens f/16, exposure 1-75th sec.

larger diaphragms for most of my work, with the result that some four hundred exposures made in Switzerland, France, Holland and Great Britain proved, on development, to be either so much diffused owing to the large stop used, or to show so much motion in moving objects, that they were useless for lantern slides or enlargements.

I then had my camera equipped with a focal-plane shutter and, after a little experimenting, found that with *f*/16, which gave desirable depth of focus, I could take street scenes and subjects, including movement, with this diaphragm, in much weaker light than I had been able to attempt with the lens shutter and the full aperture of the lens. The picture of the diver (reproduced as an illustration in this issue) is an example of this larger efficiency possessed by the focal-plane shutter. The print is the full size of the 4 x 5 plate, unretouched, just as it came from the fixing bath. The details of the figure are perfectly sharp and there is no distortion. It was made on a bright day in July with an exposure of $\frac{1}{1200}$ second, an ordinary rectilinear lens stopped down to *f*/16 being used. This is equivalent to $\frac{1}{4800}$ second at *f*/8 as far as the light admitted to the plate is concerned, so that the same result could have been obtained on a dull or cloudy day with an anastigmat at *f*/5.6.

But the majority of amateurs are not peculiarly interested in these high-speed subjects, and for them it will be interesting to know how much added power the focal-plane shutter gives for ordinary work. The fact that the focal-plane shutter at any given speed gives the plate three or four times as much exposure as any other shutter under identical conditions makes it invaluable for portraiture without a tripod in poor light, under trees or porches, at all seasons and in all weathers, at any desired time of day or year. Apart from this, the focal-plane shutter has another important advantage. Because it allows all the light admitted by the lens aperture to pass to the plate during the whole of the exposure, it is possible to use a smaller stop than would be needed with the lens shutter and yet give the plate all the exposure required by the subject. This means better definition and greater depth of field, details often important in all save landscape or pictorial work. For example, in the street view (reproduced as an illustration herein) it will be noticed that both foreground and distant objects are well defined. This view was made from the rear of a rapidly moving street car, with a rapid rectilinear lens at *f*/16, exposure $\frac{1}{250}$ second. I enclose also a view of a fountain with bronze figures (reproduced as an illustration) further illustrating the usefulness of the focal-plane shutter for ordinary work. This was taken after sunset in May, lens aperture *f*/16, exposure $\frac{1}{75}$ second. According to Wynne's meter the actinometer time was 12 seconds!

The Reflecting Hand-Camera Pro and Con

BY C. H. CLAUDY

Hand-cameras of the reflecting or reflex type are provided with a mirror which interposes at an angle between lens and plate, reflecting the image formed by the lens to a horizontal ground-glass, where it is viewed, right side up, through a hood leading to the eyes, which device cuts off extraneous light—a permanent focusing-cloth, in other words. When the picture is to be taken, a button is pressed, which releases the mirror, when a spring carries it out of the path of the rays from the lens. The mirror in moving upwards releases the focal-plane shutter, which passes across the surface of the plate and so makes the exposure. Such, briefly, is the principle of this type of camera.

Finder and Focusing

Its first and greatest advantage over all other types of cameras, save the twin-lens variety, is found in the fact that it allows the user to see the image of the object photographed, the full size of the plate and right side up, i. e., not inverted, up to the moment of exposure. The twin-lens camera does the same thing, but is twice as bulky and heavy as the reflecting camera, without any advantages over it. In other words, the reflecting camera is its own finder. Crossed lines on the horizontal groundglass enable the camera to be leveled with lines in the subject, so that the small hand-camera spirit-level and finder are alike unnecessary. Coupled with this advantage is the possibility of focusing,—for the object, which may be moving, can be followed with the focusing screw, so that the image is always sharp, no matter what the distance of the lens from the object. So the small scale by which the user of the ordinary hand-camera guesses at the focus is also done away with.

Bulk

It is an axiom that no great good is ever unadulterated, so it will surprise no one to learn that these great advantages bring corresponding troubles with them. The makers and sellers of these cameras are accustomed to state that they will do everything any other camera will do and a great deal more; but, like other advertising slogans, this is not strictly true. The use of the mirror requires a box almost cubical in shape, of a much greater bulk and weight for the size of the picture to be made than any other hand-camera. For instance, the smallest and neatest box I know of, of this type, weighs, in the 3¼ x 4¼ size, equipped with lens and film-pack, nearly four pounds, and is 5 x 6½ inches in size, roughly. Compare with an Eastman Folding Pocket Kodak using the same size film, but don't forget the added capacity of the reflecting model.

Focal Capacity

Then, too, the construction of the average reflecting camera is such that lenses of short focal length cannot be used, and wide-angle work is prohibited. The focal capacity of the box spoken of above is five to seven inches, which, while not long, hardly permits of wide-angle work on a 3¼ x 4¼ plate. This, however, is not a disadvantage, if truth of drawing is considered, and may even be considered a definite advantage. Considerations of weight and bulk limit the extension of the bellows, so that in some instruments the single combination of the lens can not be used. In others the desirable bellows length is provided, but its accommodation requires a longer box and consequently greater weight.

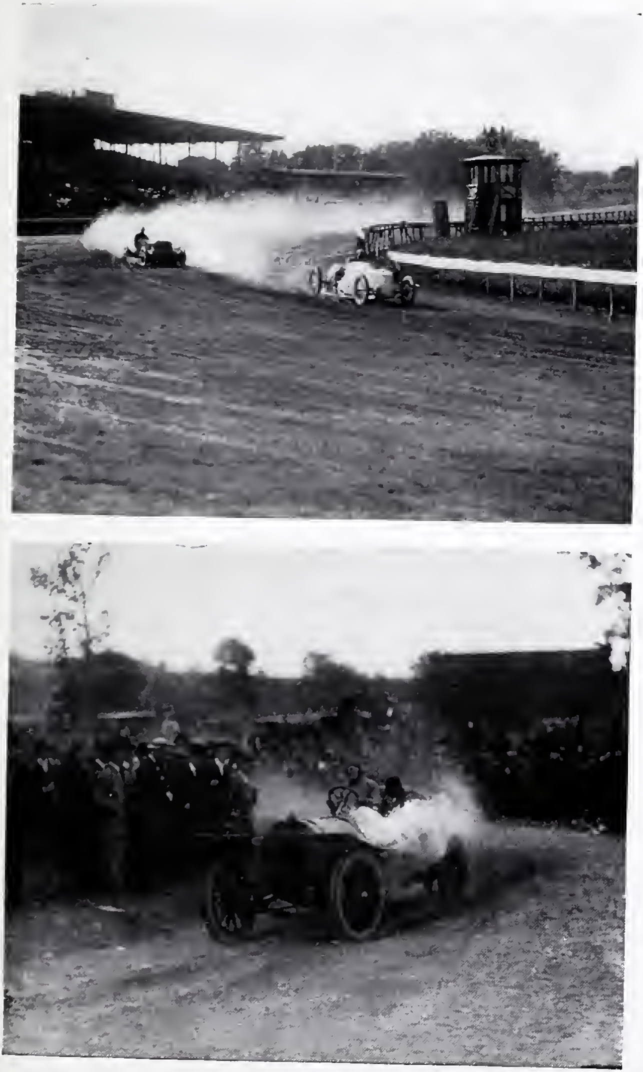
There is no objection to the type under discussion, caused by the focusing part of the mirror feature, except an indirect one. Because a lens of moderately long focal length for the plate must be used, the depth of focus when the lens is used at a large opening is decreased, and the point of infinite focus on even a small plate is extended further from the camera than is the case with other instruments making the same size picture. For instance, in my Auto Graflex I use a Cooke lens of six and four tenths inches focus, working at *f*/6.5 and the "depth of focus" obtained is much less than an Eastman Folding Pocket Kodak I have with a five-inch lens of the same speed, the advantage being due to the shorter focal length.

The Shutter

To go again to the advantages of the reflecting type of camera, the shutter is one of the most important points. A focal-plane shutter is a necessity, and an integral part of these cameras. The lens must be open during focusing, consequently no between-the-lens shutter could be used. Those who have not had practical experience with this instrument may be interested, and possibly a little incredulous, to learn that the focal-plane shutter admits from two to ten times more light, speed for speed, than any other type of shutter. Consequently it may be run much faster than other types of shutters and still give the same amount of illumination to the plate. It is obvious that if a focal-plane shutter will admit the same amount of light at a higher speed, it will admit more light at the same speed as the between-the-lens shutter and hence makes snapshots possible under conditions which that type of shutter could not negotiate. The result is that exposures can be made on objects moving very rapidly, stopping all motion, and still getting good negatives, where the hand-camera with the between-the-lens shutter would be hopelessly handicapped.

The Exposure Difficulty

To set against this and the other obvious advantages of a focal-plane shutter is the difficulty of learning to use it. Not the mechanical difficulty, for that is slight—a couple of turns of a key, the depression of a lever, etc., is about the extent of the trouble,—but the difficulty of



Upper; Made with a Graflex by F. E. Spooner. Exposure 1-1000th sec., f/6.5
Lower: Vanderbilt Cup Race, October, 1906. Made with a Graflex, Zeiss Unar f/5. Exposure 1-300th sec. by H. M. Bennett

learning what exposure to give. The ordinary shutter has speeds of $\frac{1}{5}$, $\frac{1}{25}$, $\frac{1}{50}$ and $\frac{1}{100}$ second. The focal-plane shutter has exposures from $\frac{1}{10}$ or $\frac{1}{20}$ second up to $\frac{1}{1000}$ and even to $\frac{1}{1800}$ second, and may have from twenty-five to fifty different speeds. Moreover, if a focal-plane shutter should be made, which would give an exposure of one second, the amount of light it would pass would be practically the same as that passed with any good between-the-lens shutter in that time. But the $\frac{1}{300}$ second exposure in the focal-plane shutter will let in as much light as the $\frac{1}{50}$ second exposure in the between-the-lens shutter, and this proportion increases as the speeds are increased. The faster the focal-plane shutter is run, the more light it admits in proportion to the amount admitted by a similar exposure in a between-the-lens shutter. The reason is simple: The between-the-lens shutter takes a certain interval to open and another certain interval to close. The less the time it remains open, the greater the proportion between the times of opening and closing, and the actual exposure with the full lens. With the focal-plane shutter the lens is always wide open, consequently the full focal value is always available no matter how fast the shutter runs. All this is rather confusing to one who forsakes one type for the other, and overexposed plates by the bushel are the usual result. But, once mastered, the focal-plane shutter becomes a tool which can produce some remarkable results. For instance, I recently took a picture of a man diving under the shade of a tree, in $\frac{1}{600}$ of a second, and got a first-class negative with details in the shadows of his body.

For Landscape

The reflecting camera, as used in the hand, is essentially an instrument for pictures of action, snapshots, and speed work. But it may be employed on a tripod for time exposures, like any other camera, when its peculiar advantages disappear. Nevertheless, for pictorial work it is without a peer as a trouble-saver.

When you find a view which looks promising, with an ordinary outfit you are obliged to unload, erect and focus, using a cloth, and then, if what you find is not satisfactory, you have most of the process to go over with again in some other adjoining spot. With the

Supplement No. 1, P. M. No. 77.

MARTIN'S TABLE OF EXPOSURES FOR MOVING OBJECTS

SUBJECTS	NORMAL EXPOSURES WITHOUT MOVEMENT				MILES PER HOUR	SPEED, DISTANCE, DIRECTION, EXPOSURE																										
	WITH LENS SHUTTER			EQUIVALENTS ALLOWING FOR HIGHER EFFICIENCY OF FOCAL PLANE SHUTTER SEC		12 FEET									25 FEET									50 FEET								
						↕			✕			↔			↕			✕			↔			↕			✕			↔		
	SEC	STOP				SEC	STOP		SEC	STOP		SEC	STOP		SEC	STOP		SEC	STOP		SEC	STOP		SEC	STOP		SEC	STOP		SEC	STOP	
		U.S.	F				U.S.	F.		U.S.	F		U.S.	F.		U.S.	F		U.S.	F		U.S.	F		U.S.	F.		U.S.	F		U.S.	F
STREET GROUPS not rapid	1/15	16	16	1/45	1	1/20	36	24	1/40	18	17	1/60	12	13.8	1/10	72	34	1/20	36	24	1/30	24	19.5	1/5	144	48	1/10	72	34	1/15	48	27
WALKERS slow } CATTLE grazing	1/15	16	16	1/45	2	1/40	18	17	1/80	9	12	1/120	6	9.8	1/20	35	24	1/40	18	17	1/60	12	13.8	1/10	72	34	1/20	36	24	1/30	24	19.5
WALKERS medium	1/15	16	16	1/45	3	1/60	12	13.8	1/120	6	9.8	1/180	4	8	1/30	24	19.5	1/60	12	13.8	1/90	8	11.3	1/15	48	27	1/30	24	19.5	1/45	16	16
WALKERS fast	1/15	16	16	1/45	4	1/80	9	12	1/160	4.5	8.5	1/240	3	7	1/40	18	17	1/80	9	12	1/120	6	9.8	1/20	36	24	1/40	18	17	1/60	12	13.8
VEHICLES ordinary	1/15	16	16	1/45	6	1/120	6	9.8	1/240	3	7	1/360	2	5.6	1/60	12	13.8	1/120	6	9.8	1/180	4	8	1/30	24	19.5	1/60	12	13.8	1/90	8	11.3
VEHICLES rapid	1/15	16	16	1/45	8	1/150	4.8	8.8	1/300	2.4	6.2	1/450	1.6	5	1/75	9.6	12.4	1/150	4.8	8.7	1/225	3.2	7.15	1/37	19.2	18	1/75	9.6	12.4	1/112	6.4	10.1
SKATING ice	1/10	16	16	1/30	10	1/200	2.4	6.2	1/400	1.2	4.3	1/600	.8	3.6	1/100	1.6	5	1/200	.8	3.6	1/300	.533	3	1/50	3.2	7.2	1/100	1.6	5	1/175	1.2	4.3
DIVING	1/75	16	16	1/225	10	1/200	18	17	1/400	9	12	1/600	6	9.8	1/100	12	13.8	1/200	6	9.8	1/300	4.5	8.5	1/50	24	19.5	1/100	12	13.8	1/175	9	12
SLEIGHING	1/10	16	16	1/30	12	1/240	2	5.6	1/480	1	4	1/720	.66	3.25	1/120	4	8	1/240	2	5.6	1/360	1.33	4.6	1/60	8	11.3	1/120	4	8	1/180	2.66	6.5
YACHTS	1/75	16	16	1/225	12	1/240	15	15.5	1/480	7.5	11	1/720	5	9	1/120	30	22	1/240	15	15.5	1/360	10	12.6	1/60	60	31	1/120	30	22	1/180	20	18
Cycles, horses trotting	1/15	16	16	1/45	16	1/300	2.4	6.2	1/600	1.2	4.3	1/900	.8	3.6	1/150	4.8	8.7	1/300	2.4	6.2	1/450	1.6	5	1/75	9.6	12.4	1/150	4.8	8.7	1/225	3.2	7.2
STEAMERS	1/75	16	16	1/225	23	1/480	7.5	11	1/960	3.75	7.75	1/1440	2.5	6.3	1/240	15	15.5	1/480	7.5	11	1/720	5	9	1/120	30	22	1/240	15	15.5	1/360	10	12.6
Sports, autos	1/35	16	16	1/100	24	1/500	3.2	7.2	1/1000	1.6	5	1/1500	1.1	4.2	1/250	6.4	10.1	1/500	3.2	7.2	1/750	2.2	5.9	1/125	12.8	14.3	1/250	6.4	10.1	1/375	4.4	8.4
Street cars (trolleys)	1/35	16	16	1/100	30	1/600	2.66	6.5	1/1200	1.33	4.6	1/1800	.888	3.8	1/300	5.33	9.2	1/600	2.66	6.5	1/900	1.77	5.3	1/150	10.66	13	1/300	5.33	9.2	1/450	3.54	7.6
Cycle races, gallopers	1/35	16	16	1/100	32	1/750	2.13	5.8	1/1500	1.06	4.1	1/2250	.71	3.4	1/375	4.26	8.25	1/750	2.12	5.8	1/1025	1.42	4.75	1/190	8.52	11.7	1/375	4.26	8.25	1/560	2.84	6.7
Express trams, autos	1/35	16	16	1/100	60	1/1200	1.33	4.6	1/2400	.66	3.25	1/3600	.444	2.75	1/600	2.66	6.5	1/1200	1.32	4.6	1/1800	.888	3.8	1/300	533	9.2	1/600	2.66	6.5	1/900	1.77	5.3
Flight of birds	1/10	16	16	1/300	60	1/1200	.4	2.5	1/2400	.2	1.8	1/3600	.133	1.5	1/600	.8	3.6	1/1200	.4	2.5	1/1800	.266	2	1/300	1.6	5	1/600	8	3.6	1/900	.533	3

The purpose of this Table is chiefly to guide the focal-plane worker in the choice of diaphragms. Thus it gives not only exposures based on the usual conditions, but also the diaphragms which should be used, these latter being calculated on the general basis of U.S. 16 (F.16) for the subjects mentioned *without* motion.

Explanation of Table: The various subjects are given in the extreme left-hand column; columns 2, 3 and 4 give the normal exposures and stops for such subjects *without movement;* column 5 gives the equivalent exposure, allowing for the higher efficiency of the focal-plane shutter, still *without movement;* column 6 indicates the speed at which the subjects are presumed to move, expressed in miles per hour. Next follow three sections, each section giving the exposures and diaphragms required by the subjects when photographed at the distance given at the top of each section, and for three directions of movement, as expressed by the pointed arrows over the word "stop" at the head of each division of each section. See further explanation in the article on "Calculating Exposures."

The Table is based on that given in "Wellcome's Exposure Record" for 1906 (page 229), from which most of the exposures here given for the 25 feet distance are taken. The other conditions presumed are as follows: Bright sunlight; June, 9 A.M. to 3 P.M. (except for skating and sleighing); plate 150 H & D, pyro-soda (kodak film, film-pack, etc.); developer, pyro-soda; lens, focal length, 5 inches. For tables for the conversion of values given herein for lenses of other focal length, or for equivalent exposures with other diaphragms see Supplement No. 2 and the Table of Multipliers in the article on "Calculating Exposures."

reflecting camera all this is avoided. You simply walk around from point to point until you have upon the ground glass the actual composition you want. Then, and not until then, do you set up your tripod and proceed with your time exposure, and frequently the tripod can be dispensed with.

Moreover, the use of such a camera makes for greater excellence in pictorial landscape work, inasmuch as the most enthusiastic amateur is limited to a few hours of daylight and can only take down and erect his instrument a given number of times in a certain period. With a reflecting camera one saves all that time, and is much less apt to get weary in well doing when one's observations on the ground glass are so easily made. Many unpromising bits, looked at through the camera, gain in attractiveness, yet few will take the trouble to erect an instrument and examine such places on account of the trouble. With the mirror camera there is no trouble.

The focusing cloth of the stand-camera in a wind is a little nuisance, but a very big little one at that. If the wind comes from the rear it is sometimes almost impossible to hold it over head and camera also, and many could confess to choosing a less advantageous point of view so that they could see what they are doing, when a wind said "no" to their first efforts. Obviously such troubles do not belong to the mirror camera.

For Naturalists

As a naturalist's camera the instrument is supreme. In taking pictures of insects or flowers at close range the stand-camera is at a disadvantage, as the least movement in the case of a flower will upset the focus completely. And when making a picture of an object same size, but little movement need be made to get the object entirely out of focus. With the stand-camera, this means that the focusing is all to be done over, with its consequent trouble; with the mirror-camera, focusing need never be completed until perfection is secured and on that instant the button can be pressed.

Then there is the question of price. Reflecting cameras are expensive, and they need expensive lenses to make them worth while. But their capacity for work beyond the ordinary hand-camera offsets this.

Now does it seem that I have made out a bad case against the reflex type of camera? Because the greatest argument of all is still to come. *You can do work with the reflex camera which you cannot do with any other camera at all—stand-, hand-, twin-lens or any other variety.* You can catch and stop the speediest objects, such as birds in the air—the baseball as it is hit by the bat, the railway train going seventy-five miles an hour. You can make slow snapshots of your children indoors in the afternoon in winter. You can do all kinds of snapshot work in the shade outdoors, at a good round speed. You can add an hour at each end of the photographic day for snapshot work, which means lengthening the camera season also. Your pictures are always in focus if you use care and have fair eyesight. You always know what you are taking. You see it right side up, on the ground glass, as it will look on the negative, to within a tenth of a second of the time you take it. On the other side, briefly, it is heavier, bulkier, costs more, may have less focal capacity and less depth of focus, and is a little more difficult to use than the ordinary hand-camera of the same size. So, after all, the advantages and disadvantages are to be summed up and contrasted according to the work you want to do.

Calculating Focal-Plane Exposures

When the reader is thoroughly familiar with the handling of his camera and the theoretical capacities of its focal-plane shutter, he will naturally desire to attempt the photographing of subjects including rapid movement. Here at once he faces the biggest problem in focal-plane work: how to determine the exposure required by this or that subject—children skipping in sunlight, "Casey at the bat" on a dull day, a group of restless dogs at an outdoor show, a busy street scene during the holidays, and so on. The shutter itself carries a table of available speeds, and its adjustment to any given speed is a very simple matter; but how do we arrive at the particular exposure required for the subject and conditions at hand?

The Vital Question

The primary condition for success in photographing moving objects being the elimination of motion, this question of exposure is usually put thus: How fast must the shutter work to give a sharply defined picture of the moving object in the view? Since, however, underexposure is the bane of all focal plane photography, it will be wiser to learn to put this question to oneself in a better way, viz.: How *slow* may the shutter work and yet give a sharp picture, without blur or evidence of motion during exposure? In other words, we want to find the minimum shutter speed (or maximum exposure) permitted by the movement of the subject. Here we see that in this sort of photography the movement of the subject is the hinge on which everything turns.

Tables; Short Cuts

In the text-books we will find many rules, tables and short cuts designed to help the beginner at this point. Some of these will be included in this section, with others prepared for us by Mr. J. Martin. Like all short cuts, however, these presume a general knowledge of the factors or principles involved, and are helpful or confusing according to the reader's acquaintance with the data on which they are based. Here the text-books fail, so it will be to our advantage to familiarize ourselves, first of all, with the factors or special conditions governing high-speed photography, after which short cuts and tables will be more easily understood and appreciated. Since much of what follows may be new to the reader, as rarely considered or used in every-day hand-camera work, it may look difficult because unfamiliar. There is, however, no alternative for at least some knowledge of these factors, and the success of the focal-plane expert is due simply to his practical grasp of these essentials and his unconscious use of them. To get this knowledge here, moreover, will be easier than getting it by hard and costly experience; for, if the truth be told, focal-plane photography is apt to be largely failure and disappointment until one "knows how." As we will see later, the factors are much less formidable in practice than in theory.

Prime Factors

The three essential factors governing exposures for moving objects are as follows:

1. *The speed at which the object is moving*—ultimately the speed at which the image of the object travels across the plate or film. Obviously the faster the object moves, the greater will be the displacement (or movement of the outlines) of the image on the plate, and the shorter must be the exposure. For example: reference to Martin's *Table of Exposures*, given as a supplement, shows that the exposure for an object traveling 4 miles per hour is just one-half the exposure required for an object traveling 2 miles per hour.

2. *The distance of the object from the lens.* The nearer the object is the shorter must be the exposure, because the nearer the object, the larger will be its image on the plate and its movement or displacement will thus be more apparent. Reference to Martin's *Table* again gives us the handy rule that: Knowing the exposure at any given distance, if the distance is halved, divide the exposure by two; if the distance is doubled, double the

length of the exposure. This, we note in passing, is contrary to the rule governing exposure for near and distant objects *without* movement.

3. *The focal length of the lens used.* The greater the focal length of the lens, the larger will be the image on the plate and the greater will be its apparent movement or displacement in a given time when the object moves. Hence long-focus lenses demand shorter exposures than those of short focal length. As most focal-plane cameras are fitted for one lens only, this factor will usually be constant with each worker, but the point needs attention in changing from one lens to another when the camera is fitted for the use of lenses of different focal lengths, e. g., the Revolving Back Auto Graflex.

Modifying Factors

These, then, are the essential factors. There are modifying factors which we cannot afford to overlook, and which at times offer large advantage. These are:

Direction of Movement

The direction of the movement of the object influences its apparent speed and, consequently, modifies the exposure required. For example: the actual speed of an object, and the direction of its movement from a given point of observation, may call for an exposure beyond the capacity of the largest aperture of the lens carried in the camera. Exposure under such conditions would mean blurred images, or underexposed negatives. But if it is possible to change our point of observation, we thus change the direction of the movement of the object as far as the camera is concerned and, at the same time, the apparent speed of the object is changed. Thus, when an object is moving directly across the field of view, at right angles to the axis of the lens (broadside on, as we say), the exposure is based on the actual speed of the object. But if we change our point of view, so that the object approaches or recedes at an angle of 60°, then its apparent speed is one-half its actual speed and permits us to double the length of the exposure. This may bring the subject within the capacity of our lens. When the object directly approaches or recedes, say at an angle of 10°, then its apparent speed is one-third or one-quarter the actual speed, and the exposure may be three or four times as long as that required for the broadside view. The influence of direction of movement in exposure is interestingly shown in Martin's *Table*, where the double-pointed arrows at the top of each column in the three sections indicate the direction of the movement of the object.

Counter Movement

The apparent speed of an object may also be modified by the movement of the vehicle (such as a car or boat) from which we may be photographing. Here the apparent speed of the object increases or diminishes, according as its movement is in the opposite or in the same direction as that in which we are traveling. This plays an important part in photographing yacht races or sailing vessels from another boat moving parallel with the subject or contrariwise.

Movement of Parts

The movement of parts of the object; e.g., the legs of a horse, or the arms of a man rowing, as distinct from the movement of the object as a whole, may also modify the exposure. In such cases it is generally advised to expose for the most rapidly moving part, which often means shortening by one-half the exposure required for the object as a whole.

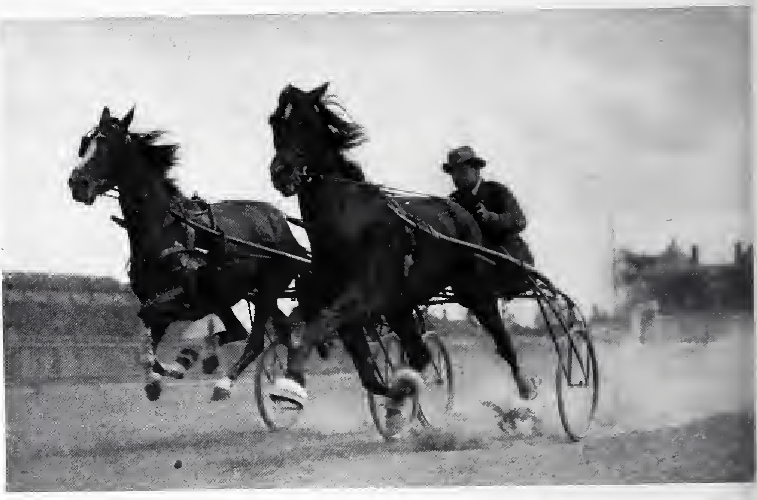
Dead Points

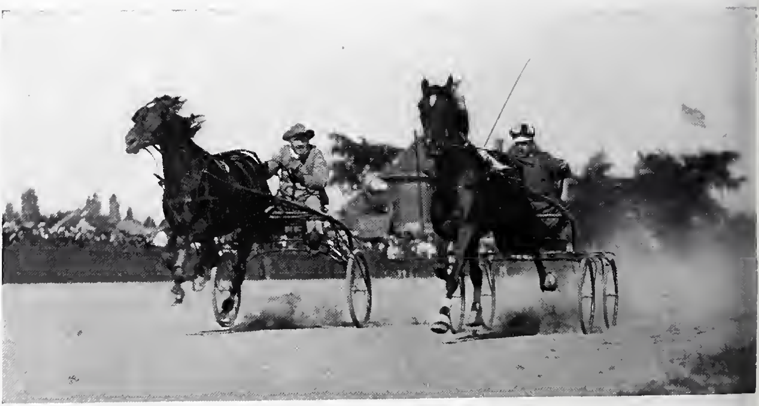
Finally, there is oftentimes practical advantage in using the period of suspended motion which forms part of all reciprocal movements. Thus, when a man or horse leaps over a high bar or fence, there is a momentary pause at the height of the leap, when he is no longer rising and has not yet begun to descend. Similarly, there is a "dead point" at the end of a stride in running, at the beginning of a stroke in rowing, and so on. To know these "dead points" and to be able to anticipate their position so as to utilize them in exposure, often makes all the difference between success and failure.

Sharp Definition

A few words about definition will be helpful before we take up the use of these factors in calculating exposures. It is obviously impossible to produce an absolutely sharp picture image of a moving object, since, no matter how infinitesimally short the exposure may be, the image

Upper: Made with a Graflex by F. M. Chapman. Exposure 1-800th sec. f/6.3
Lower: Made with a Graflex by Dr. H. H. Russell. Exposure 1-600th sec., U. S. 4





Upper: The famous trotter, Lou Dillon, and running mate, breaking the record. Time 1.58½. Made with a Graflex. Copyright by O. V. Green.
Lower: Made with a Graflex Camera. Note that both horses have all four feet off the ground.

will move on the plate during that time. Fortunately, "sharp definition" is a relative term, and we do not insist on microscopic definition in our photographs even when we have after-enlargement in mind. So, in practice, it is generally agreed that if the picture image is made up of points or discs not exceeding $\frac{1}{100}$ of an inch in diameter, the photograph will be agreeably sharp as far as the average eye is concerned. This figure, by the way, is the familiar "disc" or "circle of confusion" so often mentioned by photographic writers in dealing with questions of focusing, enlarging, etc. Taking it as a basis of definition in focal-plane work, it is plain that to get a sharply defined image of a moving object, we must find for our exposure that fraction of a second in which the image of the moving object will not move more than the allowable $\frac{1}{100}$ of an inch on the plate or film. Furthermore, we must find the *longest exposure permissible* under this condition, for, unless we can admit sufficient light to the plate during exposure to give us a developable image, all our labor will be in vain. Ultimately, then, we have to deal with the speed at which the image travels across the plate, and, for convenience in calculating, this speed is usually expressed in "inches per second."

Using the Factors

The preliminaries passed, we can now consider the use of our factors in the actual calculation of exposures. It should first be explained that all calculations and tables are based on the most favorable conditions of light, etc., the most rapid plates, etc., and for objects moving at right angles to the lens, i. e., directly across the field of view. Other conditions call for modification along the lines already indicated.

Thornton-Pickard Method

The method of calculating exposures given by the Thornton-Pickard Company, on its introduction of the first commercial focal-plane shutter in 1892, runs as follows: The distance of the object from the camera, measured in inches, must be divided by the number of yards per hour at which the object is traveling, multiplied by the focal length of the lens in inches. The result will be the fraction of a second which is the longest allowable exposure that does not show movement in the resulting picture. Putting this into a simple formula, we get

$$\frac{\text{Exposure}}{\text{in fraction of a second}} = \frac{\text{Distance of the object from lens in in.}}{\text{Speed in yds. per hr.} \times \text{focus lens in in.}}$$

For example: We want to photograph an object traveling at the rate of 12 miles (21,120 yards) per hour, at a distance of 50 feet (600 inches), with a lens of 6 inches focal length. Then:

$$\begin{matrix}\text{The}\\ \text{exposure}\end{matrix} = \frac{600}{21120 \times 6} = \frac{600}{126720} = \frac{1}{211}\text{ second}$$

Holst's Method

Another method, given by Mr. L. J. R. Holst, of the Goerz Optical Works, is as follows:

From the fact that the image of a moving object travels across the plate in the same time that the object itself travels across that portion of the field of view projected by the lens on the plate, we conclude that the speed of the image bears the same relation to the speed of the object as the size of the image bears to the size of the object. This proportion is determined by dividing the focal length of the lens by the distance of the object from the lens. Thus: If a lens of 6 inches focal length is used to photograph an object at 50 feet distance, the image will be $\frac{1}{100}$ of the actual size of the object, and, consequently, when the object moves, its image will move on the plate at $\frac{1}{100}$ of the actual speed of the object. We also know by experience that a movement not exceeding $\frac{1}{100}$ of an inch of the image during exposure does not prevent it from appearing reasonably sharp in definition. It is clear that the only factor remaining for consideration is the speed at which the object moves. Expressing this in inches per second, we get the longest permissible exposure by multiplying this value by the focal length of the lens, also expressed in inches, and by dividing the product by the distance of the object from the lens, measured in inches. This quotient, multiplied by 100, gives the divisor in the fraction of which 1 is the dividend and expresses the correct exposure for that object under normal conditions, moving at right angles to the lens. Recapitulating this in a very simple formula, we get

S = Speed of object in inches per second
D = Distance of object from lens in inches
F = Focal length of lens in inches

$$\text{The exposure} = \frac{1\text{ second}}{100 \times \frac{S \times F}{D}}$$

Example, taking the conditions given in the preceding method:

$$\text{The exposure} = \frac{1\text{ second}}{100 \times \frac{(S)\,211 \times (F)\,6}{(D)\,600}} = \frac{1}{211}\text{ second}$$

It will be seen that in this formula the value 100 determines the degree of sharpness obtained by the exposure so calculated. Consequently, if greater sharpness is required this factor can be increased, or if less sharpness is permissible a lower value can be substituted. The value 100, however, is generally accepted as a practical standard and gives very satisfactory results.

Lawrence's Method

The third and last method to be given here for calculating focal-plane exposures is that used by Mr. S. Lawrence, of the Bausch & Lomb Optical Company. To my mind it possesses distinct advantages. It is as follows: Let **D** equal the distance between the object and the lens, expressed in inches; **S** equals the speed at which the object is traveling, expressed in inches per second; and **F** equals the focal length of the lens expressed in inches. Then

$$\mathbf{E}\ (\text{exposure}) = \frac{D}{S \times 100\,F}$$

Repeating the example given for the two preceding methods, we have

D (distance) = 600 inches
S (speed) = 211 inches per second
F (focus) = 6 inches (multiplied by 100 in use)

and according to the formula:

$$\text{E (exposure)} = \frac{600}{211 \times 600} = \frac{1}{211} \text{ second}$$

With this simple formula Mr. Lawrence supplies a convenient table giving at a glance the number of inches per second equivalent to various rates of speed usually expressed in miles per hour, as follows:

Miles per hour	equals ins. per sec.	Miles per hour	equals ins. per sec.
1	18	18	317
2	36	20	352
3	53	25	440
4	70	30	528
5	88	35	616
6	106	40	704
7	123	45	792
8	141	50	880
9	158	55	968
10	176	60	1056
11	194	65	1144
12	211	70	1232
13	229	75	1320
14	246	80	1408
15	264	90	1584
16	282	100	1760
17	299		

A Short Cut When it is possible to work at a distance from the object equal to one hundred times the focal length of the lens used, then the "inches per second" figures in this table, considered as fractional parts of 1 second, may be used as the required exposure without need of further calculation—for normal conditions. For example: working at a distance of 50 feet from the object with a 6-inch lens; or at 42 feet distance with a 5-inch lens; or at 37 feet with a 4½-inch lens, and so on, the exposures would be $\frac{1}{18}$ second for objects traveling at 1 mile per hour; or $\frac{1}{100}$ second for objects at 6 miles per hour; or $\frac{1}{175}$ second for objects going at 10 miles per hour.

Made with a Graflex Camera

Lest We Forget

These exposures, as already explained, are for objects traveling directly across the field of view at right angles to the lens. If the object approaches or recedes at an angle of 45°, or at an angle of 10°, then the exposures would be double and treble respectively of that required for the broadside view.

Similarly, the rule which says that the exposure for any given distance should be doubled in length for twice that distance, or halved for half that distance, should be kept in mind when using this convenient table, which practically covers most of the requirements of ordinary focal-plane work.

Now we know how to calculate our exposures for moving objects. It must not be supposed, however, that focal-plane exposures are arrived at in actual practice by any such individual and laborious ways. Usually, indeed, there is no time for calculation of any sort. But some method and a certain amount of experiment are essential to a practical grasp of the factors. With the information here given, the reader will quickly learn how to group his subjects into general classes, and to control the variable conditions of distance and direction of movement, so that the majority of subjects will fall within a few of the many speeds given in the Speed Table attached to his shutter. More especially will experiment warn the worker against the constant alteration of the width of the shutter slit (or curtain aperture) and speed tension, as fruitful sources of failure and confusion. Thus, an expert focal-plane worker tells me that the curtain aperture of his shutter often remains unchanged for weeks together, sufficient variation in exposure for a wide range of subjects and conditions being provided for by varying the tension spring. In the soundly practical opinion of this expert, curtain apertures of 1½ inches and ½ inch respectively, with a careful use of the tension spring, will cover nine-tenths of the work usually done with a focal-plane shutter. Of course, exceptional conditions of light, weather or subject may call for wider or narrower slit openings. This experience would seem to justify the advantages claimed for those focal-plane shutters which have a series of fixed slits or apertures, as compared with the other form having a slit variable at the will of the operator.

More Short Cuts

In order to provide for those who are not inclined to calculate exposures, and as a handy guide to exposures where there is no time or chance for calculation, Mr. J. Martin has taken two standard focal-plane exposure tables and amplified them for the convenience of the reader.

Kilbey's Table

The first of these is the Table of Exposures given on page 47 of Kilbey's *Advanced Hand-Camera Work*, viz.:

Subjects	Right angles	Toward camera
Cycle racing, horses galloping .	$\frac{1}{1200}$	$\frac{1}{400}$
Athletics, men running, etc. . .	$\frac{1}{900}$	$\frac{1}{300}$
Fast trotting	$\frac{1}{900}$	$\frac{1}{300}$
Diving	$\frac{1}{800}$	$\frac{1}{275}$
Pony and trap trotting	$\frac{1}{600}$	$\frac{1}{200}$
Yachts	$\frac{1}{300}$	$\frac{1}{100}$
Water polo and football . . .	$\frac{1}{1000}$	$\frac{1}{350}$

The table is made out for a 6-inch lens at 25 feet, a 7-inch at 29 feet, an 8-inch at 34 feet, etc.

Modified by Martin

In this table we have exposures for one fixed distance only, but it is desirable to have ready at hand for use a convenient set of other values for working at various distances and lenses of focal lengths other than those mentioned by Kilbey. The accompanying chart is such a modification of Kilbey's Table, prepared by Martin for use with the Goerz *Celor*, Series 1B, focal length 4¾ inches. It is, of course, equally useful for any other anastigmat of the same focal length.

For those having a 4¾-inch focus lens, the use of this chart is simple. The ordinates (vertical scale values at right and left of diagram) represent various distances in feet. The abscissæ (horizontal scale values at top and bottom of diagram) represent the exposures for the subjects inscribed on the diagonals at the distances given on the ordinates. Example: to find the exposure required for a *horse and trap trotting* at right angles to the lens, distance from the camera 25 feet, we find the figure 25 at right- or left-hand side of scale and travel across the chart in a straight line until we intersect the diagonal inscribed with our subject. At this point of intersection we go up or down the vertical line and at the top (or bottom) we get the exposure required, viz.: $\frac{1}{480}$ second. Reference to the chart again shows that at

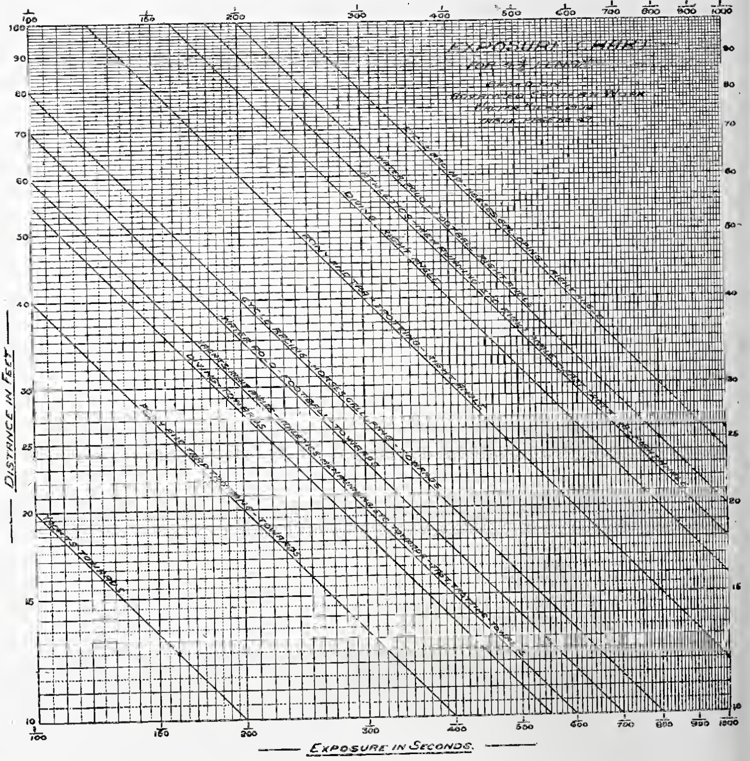
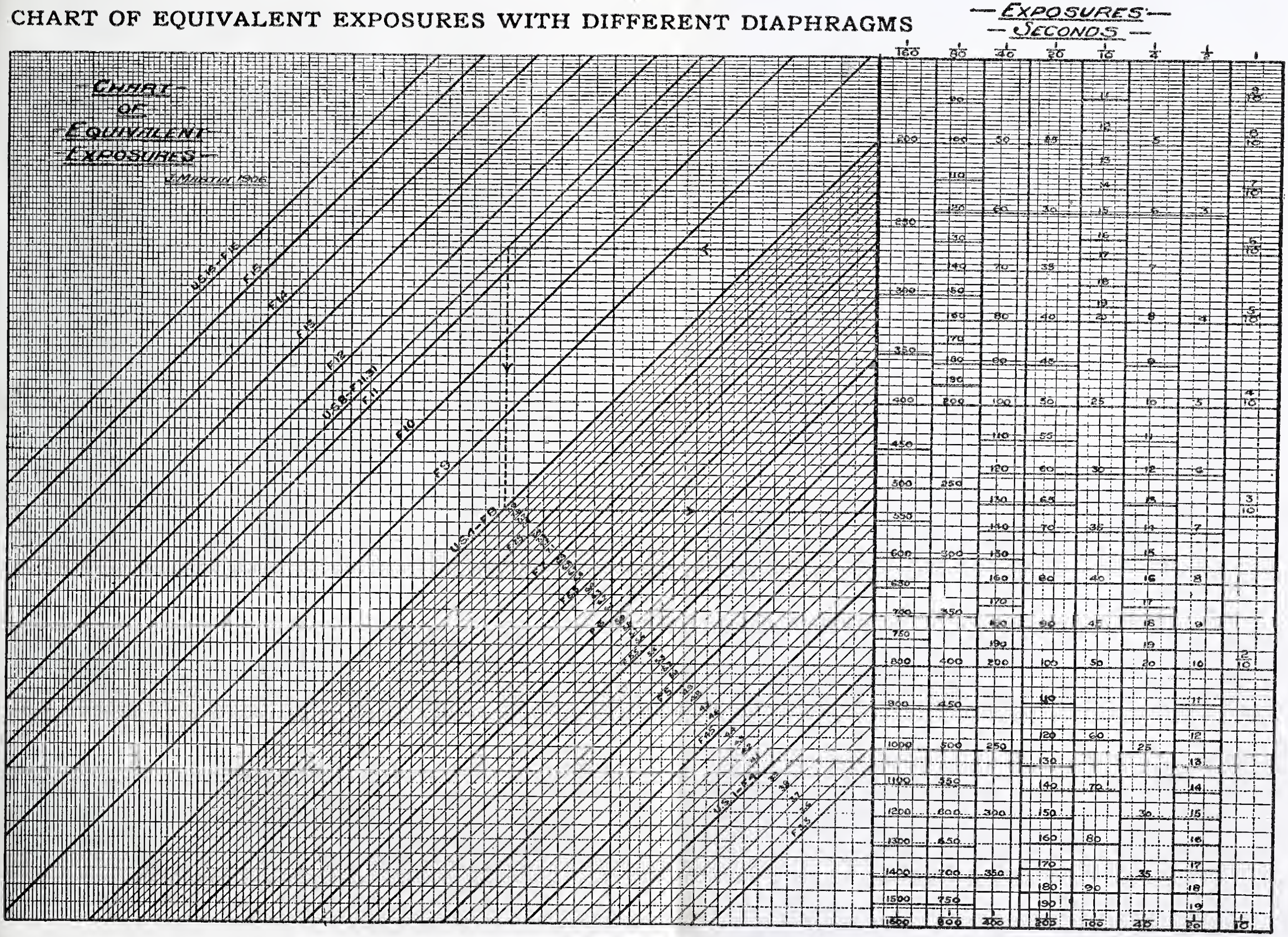


FIG. 13.

CHART OF EQUIVALENT EXPOSURES WITH DIFFERENT DIAPHRAGMS



***Explanation*:** This chart gives the equivalent exposures with any diaphragm from *f*/3.5 to *f*/16, within a range from 1 to $\frac{1}{1600}$ second. The diagonal lines represent diaphragm values, the exposures in fractions of a second being given in the eight columns at the right.

Example of Use: Given an exposure of $\frac{3}{5}$ second with *f*/11.3, what is the equivalent exposure with *f*/8. Find $\frac{6}{10}$ $(=\frac{3}{5})$ second in the extreme right-hand column. Proceed along the horizontal dotted line marked on the chart to the left until this line intersects the diagonal marked *f*/11.3; now descend the dotted vertical line at that point until it meets the diagonal marked *f*/8; turn to the right and proceed along the horizontal back to the column from which we started and we get the figure $\frac{3}{10}$ second, the equivalent exposure required. See further explanation in article on "Calculating Exposures."

50 feet the exposure for the same subject would be $\frac{1}{240}$ second; at 15 feet, $\frac{1}{800}$ second, and so on.

Making the Chart for Any Lens

The following explanation of the Chart will enable the reader, with very little trouble, to construct a similar chart for his own use adapted to the focal length of any lens desired. In the present instance, dividing the focal length of the Goerz *Celor* (4¾ inches) by 6 inches (the focal length of the lens for which Kilbey's Table was constructed), we get 0.7925 or $\frac{8}{10}$ approximately. It is now necessary to multiply the exposure values in Kilbey's table by $\frac{8}{10}$ and so we get the equivalent exposures for the 4¾-inch lens under the same conditions. Kilbey's Table and the converted values for the 4¾-inch lens are here given side by side for convenience of illustration.

Table of Exposures for Focal-Plane Work

SUBJECTS	Lens 6-inch focal length. Distance, 25 feet		Lens 4¾-inch focal length. Distance, 25 feet	
	Right angles	Toward	Right angles	Toward
A	B	C	D	E
1. Cycle racing, horse galloping	$\frac{1}{1200}$	$\frac{1}{400}$	$\frac{1}{960}$	$\frac{1}{320}$
2. Athletics, men running, etc.	$\frac{1}{900}$	$\frac{1}{300}$	$\frac{1}{720}$	$\frac{1}{240}$
3. Fast trotting	$\frac{1}{900}$	$\frac{1}{300}$	$\frac{1}{720}$	$\frac{1}{240}$
4. Diving	$\frac{1}{800}$	$\frac{1}{275}$	$\frac{1}{640}$	$\frac{1}{220}$
5. Pony and trap trotting	$\frac{1}{600}$	$\frac{1}{200}$	$\frac{1}{480}$	$\frac{1}{160}$
6. Yachts	$\frac{1}{300}$	$\frac{1}{100}$	$\frac{1}{240}$	$\frac{1}{80}$
7. Water polo and football	$\frac{1}{1000}$	$\frac{1}{350}$	$\frac{1}{800}$	$\frac{1}{280}$

Columns A, B and C are from Kilbey's Table, columns D and E being the converted values for the 4¾-inch lens. Incidentally, we note that the comparative table bears out the rule that short-focus lenses permit longer exposures than those of greater focal length.

Having in this way secured a table of converted values for the lens we desire to use, we proceed to lay out the chart. For this it is necessary to procure a sheet of Logarithmic Coördinate paper, designed by Professor W. T. Durand, of Cornell University, N. Y., and made by Keuffel & Esser Co., Fulton St., New York.

The ordinates (vertical scale values) are arranged for the distances from camera to object in feet, and the abscissæ (horizontal scale values) are arranged for the exposures in fractions of a second. For a range of distances from 10 to 100 feet, and a range of exposures from $\frac{1}{100}$ second to $\frac{1}{1000}$ second, the ordinates and abscissæ may be marked as in the chart given above. At the 25-feet distance (shown by dots in the diagram) the values from D and E columns of the Conversion Table are marked. The chart is then completed by drawing in at an angle of 45° lines through the points on the 25-feet line and suitably inscribing them with their subjects.

It will be noted that subject 6 in Kilbey's Table cannot be marked on the 25-feet distance in the chart given, but one-half its exposure value is entered on one-half its time-value as shown. When completed, the chart may be reproduced photographically to any convenient size for carrying with the camera or in the pocket.

Martin's Supplement I Exposure Table

The second table prepared by Martin, being too large for the limits of a single page, is given as Supplement I, and so may be removed for pocket use if desired. It is largely based on the *Table of Exposures for Moving Objects* given on page 229 of Wellcome's "Exposure Record and Diary for 1906" (page 233 of the 1907 edition), and appreciative acknowledgment is here made of its use.

Its Significance

The usefulness of this table, which at first sight may look somewhat formidable, will be evident after a brief explanation. It is designed to meet a very definite lack of information. All that the text-books tell us about focal-plane exposures ends with the statement that, under given conditions, the exposure is this or that fraction of a second. Not a word is said about the diaphragm or stop to be used in the lens! And yet, as we all know, the diaphragm has an all-important bearing upon (1) the "depth of focus" or depth of definition secured, and (2) the amount of light admitted to the plate in a given time. Hence the question: How do we determine which diaphragm or stop to use to greatest advantage? The expert, like the professional photographer in his studio, answers the question by his general knowledge of conditions and experience.

Since the beginner in focal-plane work lacks both knowledge and experience, his only course is to laboriously figure things out from known subjects and conditions (without movement or focal-plane shutter) to the approximate exposures under the new conditions, including the equivalent diaphragm values.

How to Use It

This Mr. Martin has done in his Table, using the Wellcome Table as his basis and expanding it, so that it includes the exposures required, under the conditions named, at three different distances and for the usual three directions of movement. In this table the usual subjects are listed at the extreme left. In the next three columns to the right are given the normal exposures with U. S. or f/16 (these being alike) for the subjects *without movement.* In the fourth column are given the equivalent exposures with a focal-plane shutter, this being allowed an efficiency three times that of the ordinary lens shutter. These exposures also presuppose subjects *without movement.* In the fifth column are given various rates of speed expressed in miles per hour. We now come to three sections or divisions, each section being subdivided into three sets of columns. Each division gives the exposures and diaphragms suited for the subjects named at a stated distance (viz: 12, 25 and 50 feet respectively) and for three directions of movement in the subject, these latter being indicated by pointed arrows at the head of each column. The diaphragm or stop values are expressed in U. S. and F figures, since all kodaks are fitted with lenses numbered according to the U. S. system (now obsolete and repudiated by its originators), while many other opticians inscribe their diaphragms with the F values. These diaphragm values are calculated from the basis of U. S. 16 (f/16) chosen for the normal exposures in the first set of columns. Thus all the figures given in the table are co-related and afford a practical guide to the exposures and diaphragms required under the specific conditions given beneath the table.

Possible Difficulties

Necessarily, since this table is the first attempt to cover a difficulty shirked or overlooked by previous writers and workers in this field, it may not, in every detail, meet with universal approval. Thus some may disagree with the normal exposures or speeds assigned to the different subjects; others may wonder at the inclusion of diaphragm values, eg. *f*/1.8, *f*/2.5, etc., which are not available in any lens now obtainable; or exposures beyond the capacities of our focal-plane shutters. Some definite basis had to be determined, however, and, this once chosen, the equivalent exposures and diaphragm values were figured out with exactness, so that, when confronted with impossible exposures or diaphragms, the reader would have a basis from which to work to other exposures or diaphragms within the capacities of his apparatus. For example: according to the Table, an express train going at 60 miles per hour demands an exposure of $\frac{1}{3600}$ second exposure with *f*/2.5 at a distance of 12 feet. The exposure and diaphragm value are alike impossible; but who would attempt such a subject traveling at right angles to the lens at that speed and distance! Passing along the line to section 3 of the Table we find that at 50 feet distance (a convenient distance) the subject approaching or traveling away from the camera at an angle of 45°, would require $\frac{1}{600}$ second, with *f*/6.5, which is an entirely practical proposition under the conditions on which the table is based. Looked at this way, as an attempt to help the reader solve a difficult problem, the table will be seen to be a great convenience.

A Chart of Equivalent Exposures

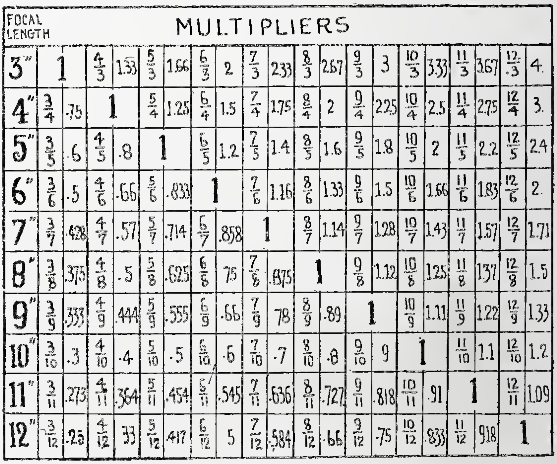
In the use of this or, indeed, any exposure table which gives a certain exposure with a given diaphragm, it is often desirable to know the equivalent exposures with other diaphragms. There are several methods of working these equivalents out in practice according to whether U. S. or F systems of diaphragm values are used. For the special convenience of focal-plane workers, Mr J. Martin has prepared a *Chart of Equivalent Exposures* which we reproduce as Supplement II, removable for pocket use if desired. It covers a range of lens apertures or diaphragms from *f*/ 3.5 to *f*/16, and exposures from 1 to $\frac{1}{1600}$ second. The diagonal lines represent lens apertures and the exposure equivalents are given in fractions of a second in the eight columns to the right. The use of the chart is indicated in the simple example shown by the dotted lines marked on the diagram. In this case it is desired to find the equivalent exposure with *f*/8 changing from a case where *f*/11.3 and $\frac{3}{5}$ second were used. Starting from the figure $\frac{6}{10}$ $(=\frac{3}{5})$ in the extreme right-hand column, and following the horizontal line to the left until it intersects the diagonal line marked *f*/11.3, then descending the vertical until it in turn intersects the diagonal marked *f*/8, we then turn to the right and proceed along the horizontal until we reach the extreme right-hand column again, and there we find the figure $\frac{3}{10}$, which is the equivalent exposure required. Similarly, starting with any given exposure and diaphragm value, we can find the equivalent exposure with any other lens aperture from *f*/3.5 to *f*/16 by proceeding from the known exposure to the diagonal representing the given diaphragm, thence up or down the vertical it intersects until we intersect the diagonal representing the diaphragm we wish to use, and traveling thence along the horizontal until we again reach the right-hand column from which we started.

The range of exposures in any one column is from 1 to $\frac{1}{10}$. It should be noted that the equivalent exposure must be a value given in the same column as the original exposure. To remove any limitations which might ensue from the use of a single column only, several columns have been given wherein the values overlap, e. g., the value $\frac{1}{200}$ second appears in the 4 left-hand vertical columns. As an example of a rare instance where it would be necessary to make use of more than one column, we may take the following. Given an exposure of $\frac{1}{100}$ second with *f*/16; wanted the equivalent exposure with *f*/4. In column 7 select the value $\frac{1}{100}$ and proceed to the diagonal marked *f*/16, thence down to the selected intermediate value *f*/11.3, returning to the 7th column from which we started, where we find the value $\frac{1}{200}$. Now transfer to the figure $\frac{1}{200}$ in column 8, proceed along the horizontal to the intersection of the horizontal with the diagonal *f*/11.3, then descend to the diagonal marked *f*/4, and return to the 8th column, where the value $\frac{1}{1600}$ (the equivalent exposure required) is found.

Equivalent Exposures for Varying Focal Lengths

Another little difficulty remains to be considered before we can leave this question of calculating focal-plane exposures. We know how these exposures are calculated, and we have dealt with tables and short cuts making the individual calculation of exposures unnecessary. We have also a table which helps us in the important detail of selecting the diaphragm for use. But this table is based on a lens of 5 inches focal length. How can we change the values

Table of Multipliers for obtaining equivalent exposures with lenses of different focal lengths.



FOCAL LENGTH	MULTIPLIERS																			
3"	1		4/3	1.33	5/3	1.66	6/3	2	7/3	2.33	8/3	2.67	9/3	3	10/3	3.33	11/3	3.67	12/3	4.
4"	3/4	.75	1		5/4	1.25	6/4	1.5	7/4	1.75	8/4	2	9/4	2.25	10/4	2.5	11/4	2.75	12/4	3.
5"	3/5	.6	4/5	.8	1		6/5	1.2	7/5	1.4	8/5	1.6	9/5	1.8	10/5	2	11/5	2.2	12/5	2.4
6"	3/6	.5	4/6	.66	5/6	.833	1		7/6	1.16	8/6	1.33	9/6	1.5	10/6	1.66	11/6	1.83	12/6	2.
7"	3/7	.428	4/7	.57	5/7	.714	6/7	.858	1		8/7	1.14	9/7	1.28	10/7	1.43	11/7	1.57	12/7	1.71
8"	3/8	.375	4/8	.5	5/8	.625	6/8	75	7/8	.875	1		9/8	1.12	10/8	1.25	11/8	1.37	12/8	1.5
9"	3/9	.333	4/9	.444	5/9	.555	6/9	.66	7/9	78	8/9	.89	1		10/9	1.11	11/9	1.22	12/9	1.33
10"	3/10	.3	4/10	.4	5/10	.5	6/10	.6	7/10	.7	8/10	.8	9/10	9	1		11/10	1.1	12/10	1.2
11"	3/11	.273	4/11	.364	5/11	.454	6/11	.545	7/11	.636	8/11	.727	9/11	.818	10/11	.91	1		12/11	1.09
12"	3/12	.25	4/12	33	5/12	.417	6/12	5	7/12	.584	8/12	.66	9/12	.75	10/12	.833	11/12	918	1	

FIG. 14.

to adapt this table to lenses of other focal lengths than 5 inches? Martin here provides a diagram which supplies multipliers for converting a known exposure with a lens of given focal length into its equivalent with a lens of different focal length. The range of this diagram includes lenses of from 3 to 12 inches focal length. Its use is obvious, but we will take an example to make it quite plain. In Martin's *Table of Exposures* (supplement) the exposure for a vehicle going 8 miles per hour, at a distance of 25 feet (angle 45°) is given as $\frac{1}{150}$ second $f/8$, with a lens of 5 inches focal length. Glancing at our *Table of Multipliers* and finding the figure 1 on the 5-inch focal length line, we see that for a 4-inch lens we have the exposure $\frac{1}{120}$ second ($\frac{1}{150} \times \frac{5}{4}$); for a 3-inch lens, $\frac{1}{90}$ second ($\frac{1}{150} \times \frac{5}{3}$); for a 6-inch lens, $\frac{1}{180}$ second ($\frac{1}{150} \times \frac{5}{6}$), and so on.

S. I. Carpenter

Made from the window of an express train moving at right angles to the subject

The Development of Extra Rapid Plates

BY T. THORNE BAKER

Despite the fact that the plate or film of ordinary rapidity is fully equal to the requirements of almost all classes of subjects under reasonably favorable light conditions, the hand camerist, as a rule, insists upon using the most rapid plate the market affords. Consequently, today, the ultra-rapid plate occupies a position of paramount importance, and is all too frequently employed where a much slower plate would do the work better, i. e., give a more satisfactory negative. So, on the one hand, the manufacturer is forced to devote attention and research to the production of high-speed emulsions, and, on the other hand, the photographer finds himself obliged to study the character and use of high-speed plates in order to get successful results with them.

Two Extremes

Let us first take the two extremes: a very slow plate and a very rapid one, and see wherein they differ. In this way we will reach an intelligent appreciation of the reasons for the methods of development herein described and, incidentally, get a better understanding of the comparative of slow and rapid plates.

The characteristics of a slow plate are chiefly: fineness of grain, freedom from the tendency to fog in development, and a readiness to give considerable opacity, so that unless carefully controlled in development, the negative is apt to be harsh in contrast or, as we say, steep in its gradation. On the other hand, the ultra-rapid plate is coarse in grain, and so does not give good "blacks" in the negative, the opacities being less compactly knit together, as it were; with forced or prolonged development it is liable to fog, being more sensitive in its make-up to the action of the developing solution and to the light used in development; finally the negative is apt to be flat or soft in character, lacking brilliancy and snap.

The Aim

Clearly our aim in developing ultra-rapid plates must be to get a sufficiently vigorous negative with as little fog as possible, i. e., to get the image out in density and detail before the period of fogging is reached. This means a developer which will give the plate with its brief exposure every possible advantage. In making up such a developer it is necessary to omit all kinds of restrainers as far as possible, and yet to prevent the developer from acting upon the *unexposed* silver bromide in the film—which would produce fog. To accomplish this simultaneously with the attainment of density requires careful consideration, and obviously development must proceed along lines somewhat different from those usually followed.

Necessity of Safe Light

As plates of very high speed almost invariably possess some red-sensitiveness, they should always be handled with the same precautions usually employed in handling orthochromatic plates. Much of the failure and lack of success experienced with ultra-rapid plates results from ignorance or neglect of this important detail. The dark-room light used in filling the holders and in development should be a good ruby or green. Two thicknesses of double flashed chromium green afford a safe light for the most rapid plate, but, no matter what light is used, the reader will be wise in testing it. A simple and practical test is as follows: Hold the plate to be tested about twelve inches away from the developing light, and facing it, for two minutes. Now, in absolute darkness, take an unexposed plate out of the same box, and develop the two side by side for, say, five minutes in a pyro-soda or metol-hydro developer. After development rinse well and fix the two plates. If on examination in daylight, after fixing, the plate exposed to the dark-room light shows more veil or fog than the other, the dark-room light is unsafe and needs adjustment. Even with a safe light, it is wise to cover the tray during the first stages of development with ultra-rapid plates and to work in full light only at the finish, avoiding all unnecessary examination of the negative during its development.

These difficulties can be wholly avoided by filling the holders in absolute darkness and adopting a system of time or tank development which can be operated with a minimum of light. As the experienced worker knows, this is by no means as difficult as it is imagined to be.

Harmonizing Developer and Plates

A great deal depends upon the choice of a developer and its adaptability to the particular plate employed. As most workers with high-speed plates are aware, one developer will give crisp images and another produce persistent fog and weak images with the same plate. This can be ascertained only by experiment, and once the most favorable combination is found, it will be obviously wise to stick to it.

Pyro Soda

The first developer we will consider is pyro, as it is peculiarly adapted to plates of high speed and allows the maximum amount of control in development.

It has already been intimated that no portion of the work done by light action during the brief exposure must be lost, and as in focal plane work, indoor portraiture in a dull light and flashlight photography, the light impression is extremely feeble, we must not sacrifice shadow detail by the use of bromide in the developer. The following developer, therefore, contains no bromide, and its clear working quality depends on the bi-product formed by its two constituents, citric acid and sodium sulphite. Make up two stock solutions as follows:

The Formula

A.—Pyrogallol, ⅓ ounce; citric acid, ¼ ounce; sodium sulphite (cryst.), 1¼ ounces; water to make 10 ounces.

B.—Sodium carbonate, 2½ ounces; water to make 10 ounces. This developer, like those to be described later, should be used at a temperature of between 55° and 65° Fahr., preferably at the mean, viz., 60°. The influence of the temperature of the developer on the clearness of the negative is so important that emphasis must be laid on this point. With underexposure such as necessarily occurs under trying or abnormal conditions, development must frequently be prolonged, and a cool developer is the readiest means to prevent "forcing" or long-continued immersion from discoloring the "whites" of the plate. It must be understood that faint detail is often buried and lost if fog appears, so that a clean negative is essential.

How to Use It

If we are reasonably sure of a correct exposure, development with the above formula may begin with equal parts of **A** and **B**. If there is any doubt about the correctness of the exposure, it is altogether safer to prepare two mixtures: one containing 3 parts of **A** and 1 part of **B**; the other consisting of one part of **A** and 3 parts of **B**. Begin development with the first mixture and add as much of the second mixture as may be required when the progress of development is seen.

There being no bromide in this developer, no fear need be entertained that by starting with 3 parts of **A** to 1 part of **B** the latent image will be destroyed; sodium citrate, the retarding constituent of the developer, is a *retarder* in actuality and cannot oxidize the exposed silver bromide. If, then, we begin development as though the plate were correctly exposed, i. e., using more of **A** than of **B**, we can get some idea of the character of the exposure. If the image flashes up, showing that the plate was grossly over-exposed, I can suggest no better remedy than the addition of 10 per cent potassium bromide solution and the continuation of development until all the details of the image are out. Now fix the plate and, subsequently, intensify to get increased density if this is needed. If, on the other hand, the image appears very slowly and the plate is obviously under-exposed, we can by pouring the second mixture into the dish render the developer normal, and add still more of **B** if it seems to be required.

With many brands of extra rapid plates difficulty is experienced in getting sufficient density in the high lights of the negative, and thus the use of rather more of **A** than of **B** is desirable in order to produce a vigorous image. If the plate was correctly exposed and the image begins to appear within 45 seconds, development may safely proceed with equal parts of **A** and **B**, or with 4

The Development of Extra Rapid Plates

BY T. THORNE BAKER

Despite the fact that the plate or film of ordinary rapidity is fully equal to the requirements of almost all classes of subjects under reasonably favorable light conditions, the hand camerist, as a rule, insists upon using the most rapid plate the market affords. Consequently, today, the ultra-rapid plate occupies a position of paramount importance, and is all too frequently employed where a much slower plate would do the work better, i. e., give a more satisfactory negative. So, on the one hand, the manufacturer is forced to devote attention and research to the production of high-speed emulsions, and, on the other hand, the photographer finds himself obliged to study the character and use of high-speed plates in order to get successful results with them.

Two Extremes

Let us first take the two extremes: a very slow plate and a very rapid one, and see wherein they differ. In this way we will reach an intelligent appreciation of the reasons for the methods of development herein described and, incidentally, get a better understanding of the comparative of slow and rapid plates.

The characteristics of a slow plate are chiefly: fineness of grain, freedom from the tendency to fog in development, and a readiness to give considerable opacity, so that unless carefully controlled in development, the negative is apt to be harsh in contrast or, as we say, steep in its gradation. On the other hand, the ultra-rapid plate is coarse in grain, and so does not give good "blacks" in the negative, the opacities being less compactly knit together, as it were; with forced or prolonged development it is liable to fog, being more sensitive in its make-up to the action of the developing solution and to the light used in development; finally the negative is apt to be flat or soft in character, lacking brilliancy and snap.

The Aim

Clearly our aim in developing ultra-rapid plates must be to get a sufficiently vigorous negative with as little fog as possible, i. e., to get the image out in density and detail before the period of fogging is reached. This means a developer which will give the plate with its brief exposure every possible advantage. In making up such a developer it is necessary to omit all kinds of restrainers as far as possible, and yet to prevent the developer from acting upon the *unexposed* silver bromide in the film—which would produce fog. To accomplish this simultaneously with the attainment of density requires careful consideration, and obviously development must proceed along lines somewhat different from those usually followed.

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With many brands of extra rapid plates difficulty is experienced in getting sufficient density in the high lights of the negative, and thus the use of rather more of **A** than of **B** is desirable in order to produce a vigorous image. If the plate was correctly exposed and the image begins to appear within 45 seconds, development may safely proceed with equal parts of **A** and **B**, or with 4 parts of **A** to 3 parts of **B**, according to the kind of negative desired, or the amount of vigor required in the contrasts of the negative by the printing-paper to be used later.

Metol

We will now leave pyro for a moment and consider metol, which I consider unequaled for the development of ultra-rapid plates with very brief exposures, provided that the plates are free from fog tendencies—in which plates differ. A metol developer without bromide will give us perhaps the largest advantage obtainable for any exposure, and the following formula is one I have used successfully for years: Metol, 73 grains; sodium sulphite (cryst.), 1 ounce; sodium carbonate, 364 grains; water, 10 ounces. Dissolve the metol in a portion of the water before adding the sulphite.

How to Use It

This developer is so energetic in its action that it is very desirable to test its suitability to your own particular plate before actual use. This is readily done, as already suggested for testing the dark-room light, by finding how much fog, if any, it produces on an unexposed plate immersed in it (in total darkness) for five minutes. For the same reason the solution should always be kept below 60° Fahr., during development, as a warm metol developer is apt to produce fog with very rapid plates.

In my own practice I place the plate in a tray, pour the developer on, cover the tray and leave the plate immersed for two minutes. The cover is then removed and the plate examined by transmitted light. According to its appearance on being looked through, it is then put back into the developer for another minute, or into the fixing-bath. Four minutes is the extreme limit of time for development with this developer, as in that period all that the exposure has effected will be revealed. Development, however, should always be carried on for at least half a minute after all the detail has appeared, or good blacks will not be obtained. Finally, where sufficient exposure has been given, the addition of 10 per cent potassium bromide solution (1 drop to each ounce of developer used) will help to keep the shadows of the plate perfectly clear and free from fog.

This metol developer, I may mention in passing, is excellent for three-color work or for orthochromatic copying, where it is often difficult to give a sufficiently long exposure, for I am of the opinion that it will "bring up" an image where the plate has received no more than half the normal exposure a plate would require with ordinary pyro-soda or hydroquinone.

Eikonogen

Eikonogen is also a developing agent with peculiar advantages for focal-plane work and extremely brief exposures on rapid plates. When used in concentrated solutions it is very energetic in action. It gives negatives of a grayish black color, not so good as "printers" as those developed with pyro. Two stock solutions should be prepared as follows:

A—Eikonogen, 200 grains; sodium sulphite (cryst.), 2 ounces; water, 10 ounces.

B—Potassium carbonate, 700 grains; water, 10 ounces.

Equal parts of **A** and **B** are used. Should the plates show any tendency to fogging, 2 grains of potassium bromide can be added to Solution **A**.

A single-solution eikonogen developer for use with rapid plates may be prepared as follows: Dissolve in 6 ounces of warm water, 100 grains of eikonogen, 1 ounce sodium sulphite (cryst.), and 200 grains potassium carbonate, with plates that have received a normal exposure. This solution may be diluted with an equal volume of water before use.

Tank Development

Owing to the enormous control which it allows, stand or tank development is peculiarly favored by many who use extra rapid plates for high-speed work. The principal feature of tank development is the employment of very dilute developing solutions, so that density is attained gradually and the shadow details of the negative have an opportunity to "come up" well before the high-lights are over-dense. Thus this method is said to give more harmonious negatives than the tray method, i. e., the contrasts are less harsh and a softer gradation is secured, so that it is peculiarly suited for the development of focal-plane exposures.

Glycin Almost any clear working developer may be used as a tank developer, the duration of development depending on the degree of dilution of the developer, which is controlled by the convenience of the individual. As glycin is well suited to work in diluted solutions, I give the following formula, which I have proved to be thoroughly reliable: Water, 100 ounces; glycin, 75 grains; sodium carbonate, 1½ ounces; sodium sulphite (cryst.), 75 grains. This developer can, of course, be used repeatedly.

Manipulation In this method the developing solution being prepared, a batch of exposed plates are put into the grooves of the stand developing boxes sold by most dealers (or a new, unused, grooved fixing-box can be used), and the developer is slowly poured in until the plates are quite covered. In this way air bells, streaks and bubbles are easily avoided, whereas if the developing box is first filled and the plates immersed afterwards, there is a continual risk of air bells, etc. Obviously this filling of the tank is done in a subdued and safe dark-room light. Development may take any time from 20 minutes to an hour or more, according to the dilution of the developer. An ordinary metol-hydro developer diluted with ten times its volume of water does not necessarily take ten times as long to develop as when the strong solution is used. But this detail can be adjusted by the reader to suit his own convenience by means of a few trials. In the use of the formula given above, remove a plate from the trough at the end of fifteen minutes, and examine by transmitted light. It will be seen at once how far development has proceeded, and the plate can either be put back into the tank or removed to the fixing-bath if sufficiently intense. Necessarily the duration of development for each negative in the batch will be determined by the amount of exposure it has received, apart from the dilution of the developer.

Review Briefly reviewing what we have learned, we may group our facts as follows: Learn to fill ultra-rapid plates into the plate-holders in absolute darkness, and to use as little light as possible during development; make sure that the light used is perfectly safe and will not fog the plates even during prolonged development; use a clear-working developer with as few restraining elements as possible, vigorous in its action, but free from fogging tendencies; keep the solution under 65° Fahr. in temperature to avoid all danger of fog; do not attempt to greatly force or unduly restrain a plate which has been abnormally under- or over-exposed, but develop normally as far as possible, fix thoroughly and then, by after-treatment, i. e., intensification or reduction, build up or reduce the image as it may need.

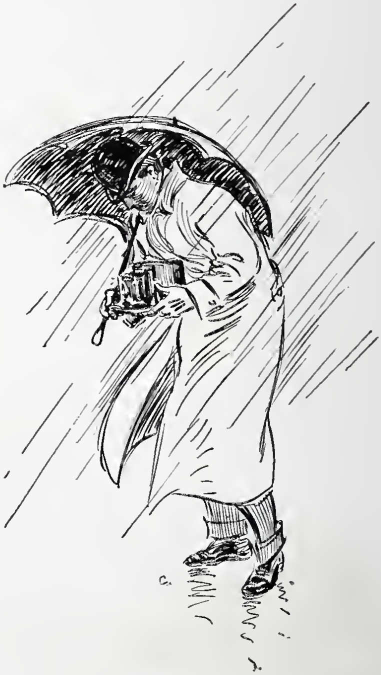
All the high-speed plates thus far introduced show a tendency toward flatness, more particularly a lack of body or opacity in the deep blacks. It is therefore advisable to employ a developer rich in reducer such as pyro, hydroquinone, etc.; on the other hand, in order to get the fullest value of an exposure which by necessity was too brief to properly impress the plate, omit bromide from the developer altogether, or use only what is absolutely necessary to keep the unexposed portions of the film perfectly clean and free from veil.

Brief Exposures with Slow Plates

Many photographers, who prefer to use plates of ordinary speed, will doubtless welcome a method of development which will give them the maximum result of their exposures with such plates. The following pyro-soda developer will give the utmost that can be obtained under these conditions. **A.** Pyrogallol, 27 grains; potassium metabisulphite, 5 grains; water, 10 ounces. **B.** Sodium sulphite (cryst.), 150 grains; sodium carbonate, 1 ounce; water, 10 ounces. Here we have no bromide and the proportion of alkaline carbonate to pyrogallol is as high as we dare go. Equal parts of these two solutions will give a soft, well-gradated negative with an exposure not exceeding one half of that demanded with the ordinary pyro-soda formula.

It should be remembered that when we use such a large proportion of carbonate to pyro, the character of the negative inclines to softness, but to compensate for this we get complete detail in the shadows. Should the negative be too soft to yield prints having the desirable amount of vigor, we recommend increasing the amount of pyro by 25 per cent.

In preparing any developer according to one's own ideas for the development of minimum exposures, the point to be borne in mind is that as little bromide and bisulphite or metabisulphite as possible should be used, and as much alkali as possible, with just sufficient sulphite to keep the negative clear and free from fog or stain.



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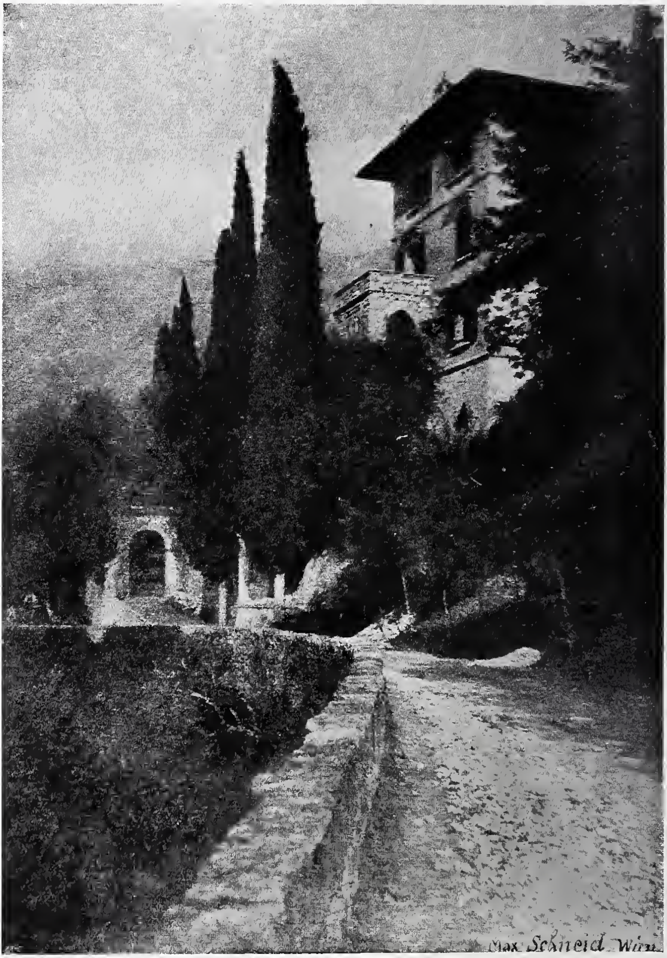


Max Schneid

From a gumprint in "Der Amateur"

The Photo-Miniature
A Magazine of Photographic Information
EDITED BY JOHN A. TENNANT

Volume VII FEBRUARY, 1907 Number 78

Printing Processes Described

It has often been suggested that a number of The Photo-Miniature could profitably be devoted to a general description of photographic printing processes, without manipulative details or formulæ. We have many text-books on separate processes, and an infinite variety of printing-papers offered commercially with little or no indication of their basic character; but what follows is the only attempt made in recent years to classify and describe them according to the sources from which they are derived. Necessarily, therefore, it is a "theoretical" number, but, for that very reason, has perhaps a practical value beyond any mere mass of formulæ and working instructions.

When the beginner in photography first turns his attention to the making of prints, his choice of a printing-paper is chiefly influenced by advertisement, and he naturally takes up that paper which is most widely and most persuasively advertised. One notes with surprise how little of originality or curiosity is evidenced by the amateur at this stage of his photographic experience. The ruling passion is to get prints as quickly and as simply as possible. There is rarely question of the paper best suited to portray the subject or adapted to the negative; or of the most important quality in a print—its permanency. Hence most amateurs know their printing-papers by a generic name which often conveys no meaning, or by a trade name, or even by the names of the firms manufacturing different papers. And yet, every different *kind* of printing-paper has its own distinct characteristics, giving a print essentially different in some particulars from any other print made on a different paper from the same negative. It is as interesting as it is important to know these differences and so be able to take advantage of them. As a matter of fact, the reader who will take the necessary care and patience to obtain as many different prints as he can find different printing-papers, from the same negative, will obtain thereby an invaluable demonstration of the possibilities of photographic printing processes, the practical benefits of which will illuminate all his after-experiences in photography.

Plain Silver Paper

The first printing-paper was introduced by Fox Talbot, in 1839–40, almost simultaneously with his announcement of the first negative process. Talbot took plain writing paper and coated it with solutions of silver nitrate and common salt, thus forming light-sensitive chloride of silver on the paper. In its essentials this is the "plain silver paper" of our own day and the basis of all our modern print-out silver papers.

Ready sensitized plain silver paper is not obtainable commercially. Its preparation and use is fully described in THE PHOTO-MINIATURE No 21. Briefly, its advantages are its simplicity of preparation and its economy, as well as the latitude it permits in the choice of a variety of different papers. It is usually prepared at home by those who use it, as it does not retain its qualities long after being sensitized. Any pure paper may be used, so that one may select rough or smooth, thick or thin, white or toned papers at will. Plain silver paper gives matt surface prints, the image being printed in rather than on the surface of the paper, hence it is chiefly used for large prints for exhibition. If a smooth paper is chosen, however, it is equally suited for small prints where sharpness of detail is not essential. The image prints out during exposure. Toned with gold, plain silver paper gives ruddy brown or purple-brown images of considerable vigor; when toned with platinum a pleasing warm black color is obtained, resembling a good engraving. If carefully manipulated and washed, and especially when thoroughly toned with platinum, plain silver prints may be considered as reasonably permanent.

Plain silver paper, prepared with iodides in place of chlorides, is largely used for commercial enlargements, being cheap and very simple in manipulation. Such paper gives an invisible image which requires development after exposure.

Albumen Paper

The sunken-in appearance of the picture image in plain silver prints quickly brought a general desire to prepare the paper in some way which would hold the image on the surface of the paper. This resulted in the introduction of albumen paper—a pure paper coated with albumen and a "salting"(chloride) solution, producing a slightly glossy surface which, when sensitized with silver nitrate, gives a brilliant picture image of considerable delicacy of detail and gradation capacity. Later the desire for more detail and greater brilliancy brought "double" albumenized paper with a heavy gloss. During the last few years the pendulum of public taste has swung to the other extreme, and we now have "matt" and even "rough" albumen papers, the earlier glossy variety being little used in America.

All albumen papers are silver chloride print-out papers and are usually toned with gold, giving ruddy and purple-brown prints. The matt varieties, however, are usually toned with platinum, giving pleasing black tones. By means of special "toners" these matt papers may be made to give blue, green, purple and red prints—all of doubtful permanency. Despite the fact that many of the early albumen prints still retain their pristine color and brilliancy, albumen prints as generally made show a tendency to fade within a few years. The process of sensitizing and using albumen paper is somewhat tedious and troublesome, as compared with other methods. The reader curious to see an albumen print can satisfy his desire by looking up any purple-brown photograph in the family album dated in the seventies or early eighties of the last century.

P. O. P. Glossy

The troublesome manipulation and uncertainty inherent to albumen paper paved the way for the introduction of the print-out silver chloride papers (P. O. P.) now in general use. At first these followed the inclination to glossy surfaces and profusion of detail, but later matt P. O. P. was brought forward and has grown steadily in favor. The preparation of P. O. P. is beyond the average worker: paper is first coated with baryta to give a perfectly smooth, inert surface, and on this a coating of silver chloride emulsion is spread, allowed to set and dried. If the vehicle carrying the silver salts is gelatine, then the product is known as gelatine-chloride paper or P. O. P., e. g., Solio in America and Ilford P. O. P. in Britain, among countless varieties. If the vehicle is collodion, then the paper is known as collodio-chloride P. O. P., e. g. Aristo Jr. in America and Paget C. C. in Britain. Glossy print-out papers are used wherever profusion and delicacy of detail is required, as in commercial work, in the cheaper grades of portraiture, and for small prints, proofing and amateur use. They are usually toned in gold, giving rich brown prints inclining to purple-brown. Like all silver, gold-toned papers, their permanency is a matter of dispute and depends largely on careful and thorough washing, with a host of minor conditions.

P. O. P. Matt

Both gelatine and collodion print-out papers are obtainable with a matt instead of glossy surface, e. g., Ilford P. O. P. in Britain, and Aristo-platino and Aristo-carbon in America. Probably 75 per cent of the printing-paper used by American professional photographers is Aristo-platino, which shows how completely this kind of paper has replaced albumen paper in this country. Matt P. O. P. is usually intended for platinum toning after a preliminary toning with gold, this giving rich, warm black tones with a peculiar softness and depth. Many brands of P. O. P., both glossy and matt, carry the toning chemicals in the film and simply require fixing, e. g., Aristo Self-toning Paper and Aristo Gold Paper. These latter are perhaps the simplest of all print-out papers in manipulation and are peculiarly adapted to give good prints from widely different negatives. Matt print-out papers are suitable for all classes of portraiture and work wherein detail and softness are desirable. As a rule, the surface is not absolutely "matt" but has a dull sheen due to the baryta coating of the paper.

Bromide Paper With the introduction of gelatine-bromide dry plates came gelatino-bromide paper, commonly spoken of as bromide paper. This is simply paper coated with a gelatine-bromide of silver emulsion, similar to that used in making plates and films. This paper is obtainable in a variety of surfaces,—rough, smooth, egg-shell, glossy, oyster-shell, tiger-tongue, velvet and so on, and in different weights or thicknesses for various uses. It gives prints by contact in the usual way, by daylight (very quick exposures) and by any sort of artificial light. Generally, artificial light is used in bromide printing as more uniform and easily controllable. Because of its sensitiveness to light, bromide paper must be handled with as much care as dry plates or films—in ruby light only. It is also largely used for making large prints from small negatives by direct enlargement — as described in THE PHOTO-MINIATURE No. 75. Bromide paper gives an invisible image after exposure and requires development, just as in negative-making. Normally the picture image is black or gray, but may be changed to "sepia" brown, blue, and so on, by various toning or redeveloping methods. A carefully made bromide print is probably the most permanent of silver prints, but the employment of toning methods introduces various causes of fading and deterioration. Because of its great variety in textures and surface finish, bromide paper is suitable for every kind of work, or subject, or negative, but is rarely used for small portrait work.

Development Papers Between print-out chloride of silver and gelatine-bromide papers comes a special class known as development papers, of which Velox paper was the first and is still the best known example. These are technically known as "washed chloride" papers, but their preparation is a trade secret. They are much more rapid than the usual P. O. P. (chloride), but somewhat slower than bromide papers and, because of their use, are generally spoken of as "gaslight" papers. There are many indications that these "gaslight" papers will eventually supersede the daylight chloride papers now in general use. They are obtainable in a great variety of surface finishes,—glossy, enameled, semi-matt, matt, rough and so on,—and in several thicknesses, and in many grades, i. e., "soft-working," "hard, for contrasty effects," etc., permitting their use with almost any sort of negative or for obtaining any desired modification from a negative. Because of this variety and latitude, gaslight papers are the most popular of papers available for amateurs. Their manipulation is simplicity itself; they need no dark-room, being workable in any soft, diffused artificial light; the prints are usually made with a gas-jet or lamp, and the picture developed in subdued light with metol-hydroquinone or amidol, after which the print is fixed in hypo-soda. Gaslight papers give gray and black tones of great beauty, resembling platinotypes. Sepia tones are obtained by redevelopment, when prints closely resembling sepia carbons are secured. Other modifications will give other colors, but with doubtful permanency. Theoretically, a carefully made development paper print should be absolutely permanent, but this evidently depends on extraordinary conditions, as the old development paper prints in my possession show signs of deterioration.

Kallitype

With development papers we have ended our survey of printing methods based on the light-sensitiveness of salts of silver. Before taking up the methods based on the ferric (or iron) salts, we will consider the Kallitype process for a moment. This is often spoken of as a silver printing process, but is practically based on ferric oxalate, although it gives a silver image. It is essentially a method for the worker who prefers to make his own paper, as the sensitized paper does not keep sufficiently long to permit its commercial manufacture and sale in the ordinary way. Briefly, any pure paper may be used. This is sized and sensitized with a mixture of ferric oxalate, silver nitrate and other salts. Exposed to daylight in the usual way, a plainly visible image is obtained, which is developed with acetate of soda and tartaric acid, borax and Rochelle salts, etc., the developed print being afterwards cleared in an acid bath and fixed in hypo-soda and ammonia solution. Various tones can be obtained by modifying the developer, the normal image being a brown or brownish black. Kallitype is a fascinating method and gives beautiful prints, but I have yet to see a print ten years old which has retained its original freshness and vigor. This is a fatal objection. The process is fully described in THE PHOTO-MINIATURE, Nos. 47 and 69, and a special variety of sensitized paper can be obtained from N. C. Hawks, Alameda, California, by those who desire to see it for themselves.

Platinum Papers

Platinum papers form a class by themselves, similar to, and yet very different from Kallitype. The platinum process is based on the light-sensitiveness of ferric oxalate, the paper being coated with ferric oxalate and a salt of platinum. By exposure, the ferric salt is changed to a ferrous salt, which has the power, when in solution, to reduce a platinous salt, so that by floating the exposed platinum paper on a solution of oxalate of potash, we get a picture image composed of pure platinum in a very fine state of division. Thus the platinum process, properly so called, gives a print in platinum, absolutely permanent and unchangeable. The normal platinum image is black, but latterly modifications have been introduced by which a "sepia" image can be obtained. In simplicity of manipulation and beauty of result, as well as in permanency, the platinum process is not surpassed by any other printing process known. Its use is naturally indicated wherever permanency is essential, and for all the better sorts of work, whether portraiture, landscape or for pictorial purpose. All platinum papers have a matt surface, i. e., the natural surface of the paper used, the sizing being imperceptible. Latterly, a special variety of platinotype paper has been introduced, having a semi-glossy surface. Some platinum papers require hot development when sepia tones are desired, with the use of mercury in the developer; others give sepia tones with cold development, and others, again, give sepia tones without mercury in the developer and with cold development. Latterly, the permanency of sepia platinum papers has been questioned, but there can be no question of the permanency of black-tone platinum papers. THE PHOTO-MINIATURE No. 40 gives various methods of "toning" black platinum prints to secure red, brown and blue tones or colors. So far as I have observed, prints so "toned" are permanent.

Blue Print Papers

Blue print papers are also based on the light-sensitiveness of ferric salts, excelling all other printing-papers in cheapness and simplicity. The color of the picture image, a vivid blue, limits the usefulness of the process, but, in spite of this, blue print paper is largely used for industrial purposes and by amateurs. For a limited range of subjects the color of the print is, of course, advantageous. There are many formulæ for the changing of blue prints to other colors, but these are uncertain in results. Blue print paper is very simply prepared, but the commercial varieties are as good as the best home-made and really cheaper when the time consumed in preparation is considered. After exposure the print is cleared by merely washing in water and dried.

Carbon Tissues

The carbon process is based on the fact that gelatine combined with bichromate of potash becomes insoluble on exposure to light. In practice a film of gelatine containing a color pigment is spread upon paper. This is known as carbon tissue. When sensitized by immersion in a solution of bichromate of potash and dried, this carbon tissue forms in effect a printing-paper for use in contact with a negative in the usual way. After exposure, the tissue is wet and is then squeegeed into close contact with prepared paper know as carbon "transfer" paper. The two pieces in close contact are now placed in warm water, when the paper originally supporting the pigmented tissue peels off, leaving the tissue attached to the "transfer" paper. By laving the warm water on the mass of pigmented tissue (on which no image is as yet visible), the soluble portions of the tissue are dissolved and the picture image is gradually revealed, i. e., developed. The color of the image so obtained depends on the color pigment incorporated with the gelatine in making the "tissue." By consulting the booklets of the various makers a range of possibly fifty color varieties is available. By re-transferring the image after its development, one can obtain prints on almost any desired support, and the variety of papers offered for this purpose is endless. In this way carbon pictures can be made on wood, metals, watch-dials, glass, etc. This process is the one printing method which every photographer should master and know familiarly, as having the widest range of possibilities in color and surface finishes for all classes of subjects and requirements, and as being simple in manipulation and yielding prints of indisputable beauty and permanence.

Gum-bichromate

The gum-bichromate process is closely allied to the carbon process in its essential features, but gives a direct print without transfer. It is usually prepared at home by the individual worker, this preparation consisting of coating any desired paper with a mixture of gum, color, bichromate of potash and water. Paper coated with this mixture is dried (away from light) and printed under a negative in the usual way. The image is not visible after printing, and the exposure is decided by an actinometer as in carbon printing. Development is effected by pouring warm water on the print, or by the use of a tuft of cotton wool or soft brush. The picture so obtained is usually somewhat loose and coarse in texture, inclining to softness and woolliness — breadth rather than fine definition of details. Hence the process is most largely used for exhibition and pictorial purposes. It offers an unlimited range of color and surface effects and an equally unlimited scope for individual treatment and handwork in development.

Ozobrome

Ozobrome, the last among printing processes in order of time, combines the carbon and the bromide methods in a unique way. It is a patented method, not as yet commercially available in America.

Gradation in Printing Papers

The capacity of different papers for giving prints differing widely in character from the same negative: How to choose among printing papers, etc.

BY WILLIAM GOODWIN

It is known, in a general way, to experienced photographers that prints differing in quality may be made from the same negative by varying the printing process, but it is doubtful if the subject has received the attention it deserves from either workers or writers. Although fairly familiar with photographic literature, the writer can not recall any systematic attempt to compare the printing processes in general use, as regards their general characteristics and capacity for rendering the gradations of the negative. Having made considerable investigation into this subject, he has been asked to put the results into such form that they may prove interesting and, it is to be hoped, useful to readers of THE PHOTO-MINIATURE.

An Experiment

Not only do different classes of papers, as for example Gelatino-chloride and Platinotype, give different renderings of the same negative, but even different brands of the same class of paper may be found to give prints of quite distinctive character. A simple experiment will serve to illustrate this, and also to help the reader to understand the methods of investigation referred to later on.

Let a piece of printing-out paper, say Gelatino-chloride, be exposed to daylight of such intensity that at the end of one minute it just shows a faint tint of discoloration. Assuming the light to be constant in intensity, continue the exposure till the paper reaches the darkest color it is capable of giving. The total time may be 60 minutes. Still assuming the light to be unchanged in intensity, choose another brand of Gelatino-chloride paper and repeat the experiment. Possibly the total time may be the same, and the appearance of the two papers similar, because there are many papers on the market which are practically alike; but it is more likely that the second paper will darken to its limit in either a shorter or a longer time, and the final tint will be lighter or darker than that of the first paper. Say that it takes 120 minutes and the tint is darker. How, then, will these papers behave when printed under a negative in which the highest light has 120 times the opacity that the deepest shadow has? Evidently the first paper will have reached its deepest color in the deepest shadow long before the highest light begins to print; if detail in the lights is to be obtained, printing must be continued till some of the shadow detail has merged into uniform darkness, while, on the other hand, if shadow detail is to be preserved, printing must be stopped before the lights are fully printed. Clearly, then, this paper is not capable of rendering properly the gradations of a negative having opacities ranging from 1 to 120. The second paper, however, will just reach the deepest tint in the shadows when the highest light is beginning to tint, and is therefore just suited to such a negative. If the negative has only opacities ranging from 1 to 60 it will exactly suit the capacity of the first paper, but if used with the second paper it will be found that when the lights are fully printed the shadows have not reached the full depth of color the paper is capable of assuming, therefore, the print will have less contrast than that on the first paper; in other words, it will be a "soft" or low-toned print lacking perhaps in agreeable contrasts.

A Test Screen

Such an experiment may serve to illustrate the principle on which papers are to be compared, but obviously it would be a tedious undertaking to watch the darkening of every paper one desired to test, even if the light remained steady for the necessary time, which it rarely does. Also, the method could not easily be applied to development papers.

If, however, the paper can be exposed behind a negative or screen, which consists of graduated tones, each of which requires twice as long a time to print as the next more transparent tone, the test becomes a very simple matter, and applicable to all kinds of papers.

In printing behind such a screen, when the most transparent tone (corresponding to the deepest shadow of a negative) has attained the deepest color the paper can give, the next tone, slightly more opaque, will begin to overtake it and eventually reach the same color. When this happens the paper has obviously reached the limit of its gradations, because, although continued printing will cause additional tints to appear at the lightest end of the scale, the dark tints will continue to merge into each other at a similar rate, so that the total number of tints or gradations visible will remain unchanged, and these tints will be few or many accordingly as the paper has a short or a long scale of gradation.

An Ideal Test Screen

The most suitable screen for such tests would be a gelatine negative, developed with a non-staining developer, and having a long series of tints rising from almost clear glass to an opacity of 400 or 500 times that of the clearest tint. The gradation should not be too abrupt, as a long scale is desirable, and probably the most useful screen would be one in which the opacity is doubled at every fourth tint. The opacity should be indicated on each tint in opaque figures, reversed. A skilful and patient worker might produce such a negative working on the lines of Hurter and Driffield (*The Photo-Miniature* No. 56). It would be necessary to expose the plate in strips to a steady light for 1, 2, 4, 8 seconds and so on, and develop for a given time, but it cannot be expected that many readers will take the trouble to do this. Not only would it be a tedious task,—and many trials would probably be necessary before a suitable negative resulted,—but the irregularities due to over- and under-exposure at the respective ends of the scale would probably prove a difficulty. It is a pity, however, that some one possessed of a Hurter and Driffield exposing apparatus and skilled in its use, does not produce such negatives for sale. They would be useful not only for testing printing papers, but also for comparing the rapidity and quality of plates, and for judging the range of gradation of negatives by comparison.

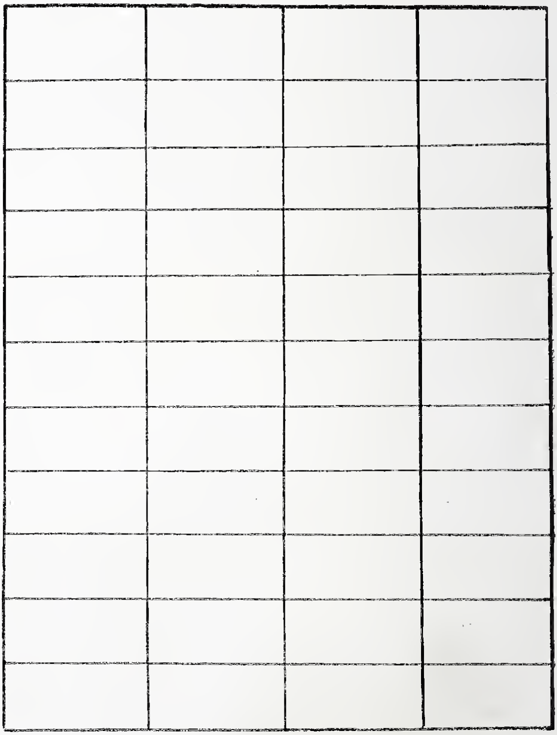
A Practical Test Screen

For the reader who wishes to prepare a test screen by some easier method, there at once suggests itself the idea of superposing layers of film of uniform, low opacity which will provide an artificial negative possessing the desired gradation. For this purpose celluloid film is useless, as the natural color and opacity of the celluloid, slight as it is, quickly accumulates as the layers increase in number, so that the gradation is entirely vitiated. The writer has used simple gelatine film, without celluloid support, with partial success, but even with that the opacity of the gelatine affects the gradation sooner or later as the layers become numerous.

How to Make It

Laying aside, then, these purely photographic methods, paper suggests itself, and the screens used in the tests made for this book have been made with this material. A pure white tracing paper was chosen, such as the Lotus tracing paper sold by the Keuffel & Esser Company, New York. To construct the screen take a clean glass of convenient size such as 3¼ x 4¼ or 4 x 5, and cut up the sheet of paper to a size just a little larger than the glass. Mark the size of the glass on a sheet of white paper by ruling round the edges with pencil lines, then remove the glass and divide the space lengthwise into eleven equal spaces, also divide it at right angles into four equal spaces, as shown in the accompanying diagram.

Now lay the glass again over the ruled sheet and touch the glass over the top space with some adhesive. Fasten down a piece of the tracing paper to this, and again apply adhesive to the top, taking care to confine it to the eleventh space. Fix a second piece of paper to this, overlying the first piece all except the bottom space. Continue in this way until ten layers are superposed, each one space shorter than the other. Thus the screen has ten gradations. Now superpose ten pieces of the paper on each other and fasten them together at the top, cut them to an even edge with knife and straight-edge, and fasten the whole down on the glass, covering three-fourths of its width, that is three of the four ruled spaces, leaving the left-hand space uncovered. There are now twenty gradations in the screen. Fasten down ten more pieces, cut to a straight edge, covering one-half of the screen, or two of the ruled spaces, and finally fasten down ten more pieces covering the remaining right-hand, fourth space. There are now forty gradations, each increasing by one layer of paper.



The difference in opacity between the gradations will of course depend upon the transparency of the paper, but this number of layers will be found more than sufficient even with the most transparent kind. The more transparent it is the longer the scale will be, and therefore the more useful. The gradations must now be numbered, the figures being reversed so that they may come right in printing, and the easiest way to do this is to write them on thin celluloid,—a piece of cleaned-off roll-film will do. Lay this on the ruled paper diagram which was used as a guide in making the screen, and, beginning at the *right-hand lower corner*, write the figures in thick Indian ink (Higgins India ink) numbering upwards 1 to 10; then beginning at the bottom again, number the second row upwards 11 to 20; the third row 21 to 30, and the fourth 31 to 40. When dry turn the celluloid over and lay it down on the screen, when the numbers will be seen to come in their proper places, but reversed. Fasten it down by binding the top with black paper, which will also serve to mask off the eleventh space which was used for the adhesive. The celluloid not only serves to carry the numbers, but also protects the paper from dirt- and silver-stains.

How to Use the Screen

For simply comparative purposes, the screen may now be taken into use without further work upon it, but if it is to be used for ascertaining the class of negative best suited to the paper that is being tested, the *relative values* of the gradations should be determined by trial. For this purpose artificial light should be used, as daylight is too variable. Take a 4 x 5 piece of Bromide paper (in a dark room of course) and holding it, sensitive side down, cut a little piece out of the lower left-hand corner. Place this little piece over No. 1 on the screen, and expose for 5 seconds at 10 feet distance from a No. 5 flat-flame gas-burner. Remove it and substitute the rest of the sheet of Bromide paper. Expose this for 10 seconds, and develop both pieces together in the same dish. Watch carefully what number begins to tint at the same moment as the little piece does. It will probably be No. 3 or No. 4, indicating that that number has twice the opacity of No. 1. Repeat the experiment, giving 5 and 20 seconds when 3 or 4 more tints will appear, and in this way a table may be compiled from which the opacities of all the tints making up the screen can be read off. It is reasonable to assume that the tint which appears along with No. 1 (which has had 5 seconds) and shows the same depth of color after fixation, has received an equal amount of light-action during the longer exposure; but as very small errors of observation which do not much matter in the lower numbers will be greatly multiplied in the calculated opacities of the higher numbers, these latter should be tested here and there by actual trial, when, as a rule, the calculated opacity will be found too high.

It is important to know, with some degree of accuracy, the values of the numbers in the neighborhood of Nos. 15 to 20, as in that part of the scale the majority of papers register their maximum. Not knowing what kind of paper the reader may be able to obtain for his screen, it is difficult to suggest what the relative opacities obtained may be, but as an example of a test the writer found that, with the tracing paper he used, gradation No. 1 of the screen gave the same tint with 5 seconds' exposure as gradation No. 13 gave with 320 seconds, therefore their relative opacities are as 1 to 48.

In comparing tints, either when testing screens or when finding the contrast of negatives by similar means, it is absolutely necessary to cut out the parts to be compared and examine them apart from surrounding tints. Any attempt to compare them while mixed with other tints is extremely misleading, and the writer was lead into considerable error through neglect of this precaution in his earlier experiments. An opaque shield of black paper large enough to cover the screen and pierced with a single opening as large as a single space on the screen will be found useful for this.

Gradation Capacity of Plates

Before proceeding to discuss the different printing-papers, it may be of interest to say something about the gradations that gelatine plates are capable of giving. The writer recently made some experiments bearing on this question.

Several popular brands were chosen and exposed behind one of the graduated screens. A four-grain amidol developer was used, and development was prolonged till the denser parts were completely through to the back and all developing action seemed to have ceased.

Very striking differences were found between different makes of plates. In some, quite a number of the most exposed divisions of the scale had run up against the glass, so to speak, and were equal in opacity, while in some cases signs of reversal could be seen when the exposure was sufficient to bring out nearly the highest opacities of the scale. In other cases nearly the whole scale was clearly rendered, one plate in particular giving the entire scale clearly, without halation. Of course all the plates were backed.

As the opacity of the gradations on these plates could be ascertained only by direct experiment, tests were made on the same principle as the tests of the screens, and the range of opacities was found to range from 1 to about 700 in average plates, and 1 to over 1,000 in the best, and these opacities are due to silver alone, no developer stain being present.

In these figures the value 1 is assigned to the faintest deposit that has any printing value, as no really good negative has any quite clear glass.

As will be seen from what follows, these opacities are far beyond the capacity of any printing-paper, but it seemed improbable that actual negatives would use the full capacity of the plate, and some tests of negatives were therefore made. The method employed was the same as before; viz., finding the relative exposures required to give an equal tint to the deepest shadow and the highest light that is required to print. In some negatives there may be patches of extreme density which are never required to print, therefore the highest light was considered to be that which would show on a print-out paper print as a slight tint before toning and as pure white in the finished print.

Negatives Ancient and Modern

Negatives made in recent years, using modern soft-working, non-staining developers, gave unexpectedly low ranges of gradation. Ordinary landscapes with foregrounds averaged about 1 to 50 opacities, many not exceeding 1 to 40. Interior subjects, flower and still-life studies owing to the deeper shadows, ranged higher, about 1 to 100 or 150. Negatives made in the days of pyro-ammonia and albumenized paper ran much higher, 1 to 250 and even 350 being found in what were good negatives in their day. These latter would seriously overtax some of the papers of the present day, but of course the introduction of so many soft-working developers has produced quite a different type of negative, and manufacturers turn out their papers to suit the new conditions.

To return to the consideration of printing-papers, tests made with the screen will often show quite surprising differences, but the inexperienced photographer should not jump to the conclusion that the differences indicate inferiority in any make of paper. Every paper in the market is good for some kind of negative, and a really bad paper could not stand against its competitors.

PRINTING-OUT PAPERS

Their Gradation Capacity

Amongst all the printing processes now at the command of photographers, those which give a fully visible image in the printing-frame undoubtedly remain most popular, especially those gelatino- or collodio-chloride papers familiarly known as P. O. P. or print-out papers. They are all capable of rendering a fairly long range of gradation, but it is noticeable that one kind differs from another, sometimes to a considerable extent, and that even the less enterprising photographer who shuns carbon or platinum because he "likes to see what he is doing," will find some advantage in using more than one make of print-out paper. They differ in the extent of gradation they register, ranging between opacities of 1 to 64 and 1 to 256. That means that a negative possessing a large range of contrast may have all its tones registered on a paper of the latter class, while on the former class there must be blocking up of shadows or loss of detail in lights with such a negative.

A still more important difference, however, lies in the steepness of the gradation. Two papers may be found which register exactly the same number of gradations, but the depth of color attained in the deepest shadows may be very much greater in one than in the other. The discoloration due to the action of one unit of light and twice that unit is not the same in all papers, and the difference may be illustrated by two flights of stairs one having higher steps than the other so that one rises to a greater height than the other for a given number of steps. These two papers will give prints of a different character from any negative. If the negative contains the same gradations as the paper is capable of rendering, the steeper paper will give the most "brilliant" print, but both prints will be good, each in its own way. If, however, the negative is flat, and within the scale of the paper, the steeper paper will give the better print. On the other hand, of course, the softer paper will best render a harsh over-developed negative, because the shadows will be lighter in tone, although they will contain no more detail; i. e., the print will be softer.

A Peculiarity

The gradation in all printing-out papers presents a certain important peculiarity. Examination shows that, in the examples illustrated, there is a gradual decrease in the steepness of gradation toward the shadow end which becomes very marked in the deeper tones, where the difference between any two contiguous exposures becomes hardly perceptible. The explanation is simple. As the silver compounds darken during printing, the discolored particles act as a screen to those lying beneath them, so that the darkening of the latter is delayed. The greater the amount of darkening the greater the screening effect, hence the lighter of two tones tends to overtake its darker neighbor, and the contrast between them is less than the contrast between the corresponding tones of the negative used. The effect of this is to soften the shadows of the print and lengthen the scale of gradation, as will be seen by comparison with other classes of papers where this screening effect does not arise. At the other end of the scale there is also a somewhat abrupt falling off in the gradation not quite so easily explained. It will be noticed that the gradations *print out* clearly enough, but that they disappear, or are disproportionately reduced during toning and fixing.

The Result The writer ascribes the loss of these delicate tones to the fact that silver chloride prints out more rapidly than the organic silver compounds which are associated with it, and which give richness and depth of color to the print, hence the lighter tones consist mainly of chloride alone, which is more reduced during toning and fixing than the organic compounds. This seems the more likely because in these experimental prints the lightest tones—those which suffer most in the after-processes—are, when taken from the printing-frame, distinctly bluer in color than the somewhat darker tones adjoining. The conclusion is therefore inevitable that printing-out papers cannot possibly give a correct rendering of the negative, although their vast popularity indicates that they give a rendering which pleases the majority of photographers. No doubt the softening in the shadows is rather welcome than otherwise, while the abnormal gradation at the other end of the scale gives a certain sparkle or brilliancy which is equally desired.

The strength of the light in print-out paper printing does not seem to affect the total range of gradation much, but it does affect its character. Printing in the sun considerably strengthens the detail in the lights. It seems that the stronger light causes the earlier formation of the organic compounds which I have already spoken of, so that the abrupt falling off in fine detail, due to the absence of these compounds, does not take place, hence the advice to print dense negatives in the sun is sound. Different classes of paper vary in this respect. Those with short and steep gradation show little difference, but long-scaled papers show it very distinctly.

Influence of Surface The surface of the paper has considerable influence on the rendering of gradation. It appears that when the coloring matter is spread throughout a comparatively thick layer of transparent medium such as gelatine, there is a depth and transparency which is lacking when the particles are crowded into a thin layer. No doubt the gelatine acts as a varnish, preventing the surface reflections which rob the shadows of depth when the surface is "matt." Enameling still further improves the depth of shadows and enables minute differences of shadow gradation to show themselves, which would be invisible even with the natural gloss of the paper.

Atmospheric Influences

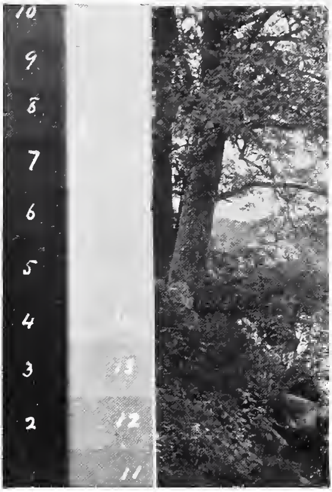
The editor has suggested that weather conditions affect the gradations of print-out papers, and it seems likely that excess of heat and moisture occurring together would have some effect. The writer, living in Scotland where damp heat is unknown, could test the point only under artificial conditions. It appears that when the atmosphere is dry print-out papers give brighter prints than they do when moisture is excessive. As might be expected, gelatino-chloride, owing to the hygroscopic properties of the gelatine, is more sensitive to atmospheric conditions than collodio-chloride. Generally speaking, prints made in winter show more contrast than those made in summer, partly owing to the drier atmosphere in the cold weather, and partly to the weaker, i. e., more diffused light of the winter season.

Examples

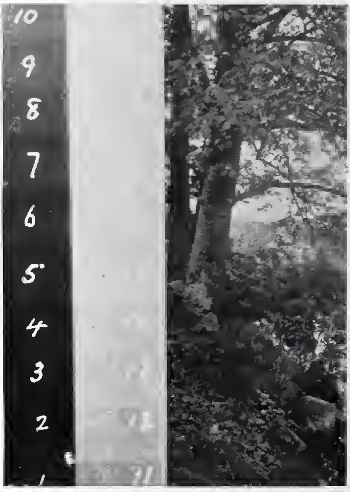
The illustrations of print-out papers given in the accompanying plate show prints made under the paper screen, and, beside each, a print from an average negative. This negative has gradation from 1 to 48, the highest light being the sky just to the right of the tree, and the deepest shadow is under the stone in the foreground. This gradation is equal to 13 tints of the screen. At the moment of writing it is impossible to say whether the process of reproduction will show these minute differences of tint sufficiently plain for comparison.

Fig. 1

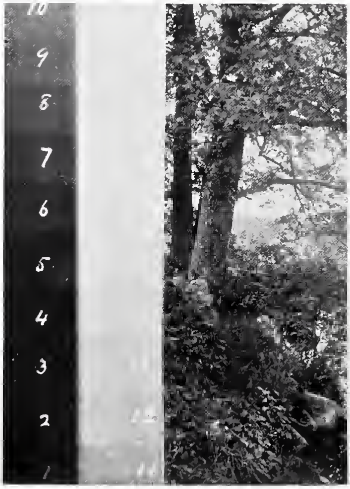
In the original prints, Fig. 1 has the highest light in the picture printed to the same depth as No. 16 on the screen scale, while the deepest shadow is the same as No. 4. thus using the 13 tints. This is one of the steepest and shortest papers in its class, and all the papers approaching it are, like itself, self-toning papers. Whether this is merely a coincidence, or is a feature of such papers, is of course known only to the makers. This paper, as may be seen from the scale, reaches its deepest color when No. 18 is just showing, which indicates that it is not capable of dealing with negatives



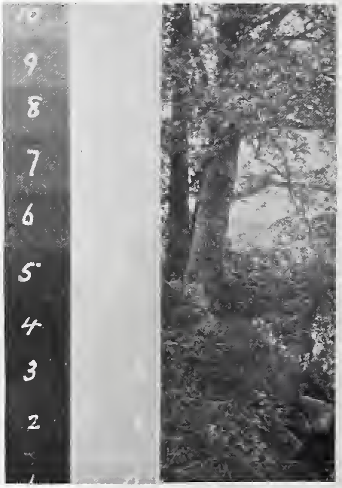
SELF-TONING PRINT-OUT FIG 1 STEEP GRADATION



SEPARATE TONING & FIXING FIG 2 EXTENDED GRADATION



P.O.P GLOSSY FIG 3 MEDIUM GRADATION



P.O.P. MATT FIG 4 SHALLOW GRADATION

of contrast greater than 1 to about 250. In practice, however, none of the print-out papers should be used to anything like its theoretical capacity. Examining the scale carefully, it will be seen that from No. 18 to No. 5, there is a clear and distinct difference between each tone, but, although Nos. 5, 4 and 3 show some difference, it is very slight and of little practical use in a print of mixed tones. Its *practical* range, therefore, is from No. 4 to No. 18, indicating a negative of 1 to 64. This difference between the *utmost* gradation shown by any paper and its *practical* gradation should always be borne in mind when making screen tests, the practical graduation stone being regarded.

Fig. 2

In Fig. 2 we see one of the longest and flattest scales met with amongst print-out papers. This is one of the ordinary gelatine papers for separate toning and fixing. The original print shows 20 gradations, which would indicate a negative of about 1 to 500, but its *practical* range is at most 16 tints, which means that it could deal with a negative of 1 to about 128.

Comparisons

Comparing the scales of Figs. 1 and 2, it will be seen that the latter does not reach the same depth of color as the former, also that the difference between any two adjoining tints is less, hence with any given negative details will not be so sharply differentiated. This may be seen in the print alongside, in which the 13 tints extend from No. 19 to No. 5, and any attempt to print the shadows deeper would have only degraded the lights; therefore to get the full scale of such a paper utilized, a negative of greater contrast is needed, say about 1 to 120 at least.

Figs. 3 and 4

The majority of the popular brands of print-out papers are intermediate between these, as shown by Fig. 3, which with *practical* range of 1 to 16, equaling a negative of about 1 to 128, gives a greater depth of shadow than Fig. 2. Generally speaking, "matt" surface papers give softer prints than glossy papers, having a long and rather shallow scale. For comparison, matt solio is shown by Fig. 4, glossy solio being Fig. 3.

Pre-exposure

A very remarkable extension of the scale results from pre-exposing the paper until it is faintly tinted. Careful experiment along this line gave a range of 26 visible tints; which would indicate a very strong negative indeed, but the practical value of this is doubtful, not only on account of the degradation of the lights, but because most papers so treated show a disagreeable pinky tinge in the lights after toning. In conclusion, it should be remembered that all papers of the print-out class must be fixed before judging their gradation. The condition of the fixing-bath may considerably affect the finer details, and there is certainly a loss of detail if prints are allowed to go into it in an acid state. The best safeguard is to put a pinch of washing-soda or a few drops of ammonia into the hypo-bath; i. e., the fixing bath should be neutral, inclining to alkalinity by litmus test.

PLAIN SENSITIZED PAPERS

These appear to have almost gone out of use, yet for several reasons the amateur of the present day would find this process worthy of his attention. The artistic taste which has been so much in evidence in the photographic world in recent years will find wide scope in the varied surfaces and tints of the numerous different papers available for sensitizing, while the great range of tones obtainable—reds, browns, purples and blacks—adds considerably to the value of the process.

Full details of the preparation and working of the papers will be found in THE PHOTO-MINIATURE No. 21. Briefly, the paper is coated with a size of starch, gelatine or resin, in which a certain quantity of a soluble chloride, together with an organic salt such as a citrate, has been dissolved. After drying, it is rendered sensitive to light by brushing over it a solution of silver nitrate. One of the chief merits of the process is that by adjusting the quantities and proportions of the salts, or by adding others, the gradation of the prints can be largely controlled, and the paper can be exactly suited to give the best result from the particular negative for which it is intended.

Suiting Paper to Negative

The published formulæ give from 6 to 10 grains of chloride of ammonia per ounce of sizing solution, but less or more may be used if necessary. As a general rule, the quantity should be lowered for a contrasty negative and increased for a flat one. For a negative having gradation 1 to 40 or 50, six grains of chloride, with proportionate citrate, gives a pleasing result tending to softness, but a more vigorous print from the same negative will be obtained by doubling the quantity of all the salts. Negatives of less contrast, even so thin as to be useless for commercial printing-out papers, may be successfully dealt with if a small proportion of a bichromate is added to the other salts. This has the effect of shortening the scale of gradation enormously, so that, if sufficient has been added, the merest "ghost" of a negative will yield a strong print.

Figs. 5, 6, 7, 8

The illustrations given show the extent of the control so obtained in printing from the negative used in previous illustrations. Fig. 5 is a paper prepared according to Clark's formula, the first given in THE PHOTO-MINIATURE No. 21, containing 6 grains of chloride. Fig. 6 has the chloride and citrate doubled. Fig. 8 shows the effect of adding to the latter solution 1 grain per ounce of potassium bichromate; more may be used for extremely thin negatives, 4 grains per ounce giving an exceedingly short, steep scale comparable to the slowest of the gaslight bromide papers. (Fig. 7.) It has been suggested that variation in the opposite direction may be obtained by adding to the sizing solution a few grains per ounce of sodium phosphate, which flattens and lengthens the scale, but its effect is comparatively small. When this is used with a view to securing a soft print from a hard negative, all or most of the citrate should be omitted, and the chloride should be reduced to say 4 grains per ounce, and the silver sensitizing solution should be reduced in strength.

Manipulation

These plain papers, as generally prepared, are strongly acid and contain a large excess of free silver nitrate. To insure even toning and economy of gold the free silver

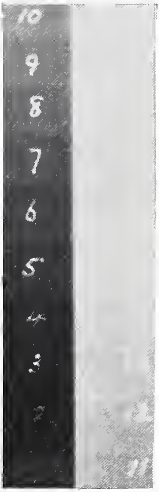


FIG 5

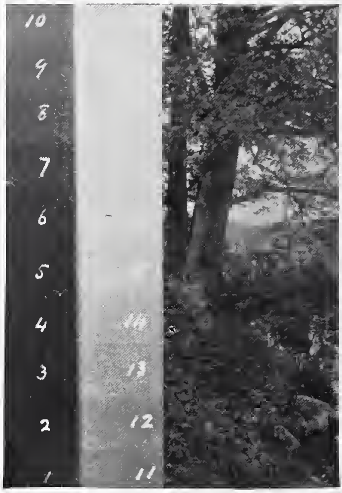


FIG 6

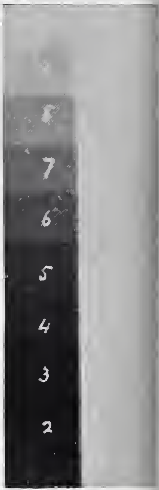


FIG 7

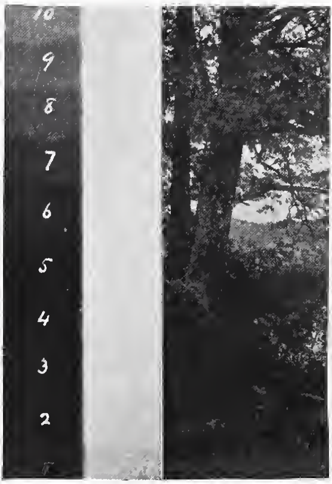


FIG 8

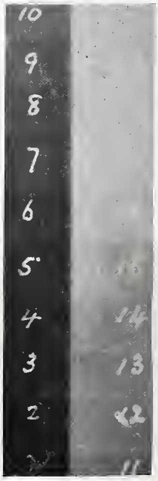


FIG 9

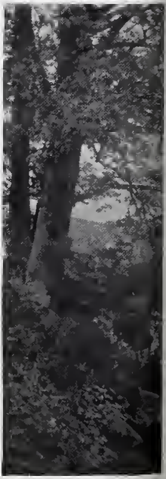


FIG 10

nitrate must be removed before toning, and to avoid complicating the toning bath, and also to avoid decomposition of the hypo bath, the free acid must be neutralized. Both objects may be achieved by treating the prints during the preliminary washing, with a bath of common salt and washing-soda. These may be used separately or mixed according to the taste, and the strength is not of great importance—say half a teaspoonful of each in a pint of water, followed by rinsing in pure water. If the prints are to be toned with platinum, which is specially advisable for these papers, the soda must be used after toning, as the platinum bath must be acid, but the salt bath should be used before toning. If a print in an acid condition is put into the hypo fixing-bath, not only is its permanency endangered, but its gradation is affected as the more delicate tones are "eaten out." Trouble of this kind is avoided if a little washing-soda is dissolved with the hypo. These remarks apply to all printing-out papers, as it is necessary, to ensure their keeping properties, to have them acid, and of course they all contain free silver salts more or less.

Obviously, in testing printing-papers of all kinds, the gradation must be judged after they have undergone all the operations necessary to produce a finished print, as the final result is always more or less different from the print as it leaves the printing-frame.

ALBUMEN PAPER

Although not used so generally as in former years, there are signs of a returning popularity for albumen paper. This paper has a long and flat scale of gradation suited to vigorous negatives. By the kindness of a friend who is a veteran in photography, the writer has been able to try some of the paper over 40 years old, and this paper, sensitized on a 50-grain silver bath, is shown in Fig. 9. Such a paper was well suited to give delicate prints from the strong collodion negatives then in use, but would give a very flat print from a modern average negative. Fig. 10 shows a more recent type of albumen paper.

Leaving these processes in which the image is fully visible in the printing-frame, we turn to others which, while they have the disadvantage of being partly or wholly invisible during printing, have the reputation of greater artistic capabilities, and the undoubted virtue of greater permanence.

THE CARBON PROCESS

This process, known also as autotype and pigment printing, claims first place, owing to the great variety of color effects and surface it offers. It is a peculiarity of this process that its range of gradation is variable at will, over fairly wide limits, by varying the strength of the sensitizing bath. An average bath of 4 or 5 per cent of bichromate will give a range about the same as the majority of the print-out papers, but for such a gradation a negative of a considerable range of opacities is needed to bring out the full value of the rich deep shadows which are characteristic of the process. If, however, the tissue is sensitized on a bath more diluted, the range of gradation is shortened and rendered much steeper, and the negative may be correspondingly thinner. On the other hand, tissue to suit a negative of extreme contrast may be prepared by sensitizing on a bath of greater strength up to about 8 per cent.

Not only is the range of gradation of carbon tissue variable by altering the sensitizing bath, but the same piece of tissue will give very different results, according to the time elapsing between sensitizing and printing. From the time it becomes thoroughly dry, its sensitiveness increases with the lapse of time, but the growth of sensitiveness varies with the prevailing temperature. As the tissue becomes more sensitive its range of gradation increases. It will thus be seen that the photographer who uses this process intelligently has great control over the results obtainable from his negatives. If a negative which is unduly "flat" has to be dealt with, the contrasts in the print will be greatly increased by sensitizing on a very weak bath, say ½ per cent, and using the tissue as soon as dry, while a harsh or "hard" negative gives the best results on tissue sensitized strongly, and kept as long as possible.

Deterioration There is a limit to keeping, however, as the tissue gradually becomes "foggy" and quite insoluble, sooner or later, according to temperature and the conditions of keeping. It should always be kept air-tight, preferably in a tin. It is said that by keeping it absolutely dry in a calcium tube, as used for platinum papers, the increase in sensitiveness is prevented and insolubility is prevented indefinitely. Gas fumes and the sulphurous atmosphere of towns cause the tissue to fog during drying, and the writer strongly advises that it should be squeegeed down on glass or ferrotype plate during drying, thus protecting the surface from such impurities.

Its Range of Gradation The range of gradation carbon tissue is capable of rendering under varying conditions may be gathered from the following experiments which were made during a period of average summer weather, when the temperature of the room in which the tissue was dried and stored did not vary much from 65° Fahr.

Twelve hours after sensitizing the gradations were:—8 per cent bath, 17 tints, equaling a range of opacities about 1 to 192; 4 per cent bath, 16 tints, equaling about 1 to 128; 1 per cent bath, 15 tints, equaling about 1 to 96; ½ per cent bath, 14 tints, equaling about 1 to 64.

After keeping five days: 8 per cent bath, fogged and therefore useless; 4 per cent bath, 17 tints, equaling about 1 to 192; 1 per cent bath, 16 tints, equaling about 1 to 128; ½ per cent bath, 15 tints, equaling about 1 to 96.

After keeping ten days:—8 per cent bath, tissue quite insoluble; 4 per cent bath, fogged and useless; 1 per cent bath, 17 tints, equaling about 1 192; ½ per cent bath, 16 tints, equaling about 1 to 128. Similar experiments made in winter when the temperature of the room did not rise above 50° Fahr., and at times fell at night to 30° Fahr., showed that the tissue was less sensitive to begin with, and ripened more slowly. The results obtained were approximately as follows:

Twelve hours after sensitizing:— 8 per cent bath, 16 tints, equaling about 1 to 128; 4 per cent bath, 15 tints, equaling about 1 to 96; 1 per cent bath, 14 tints, equaling about 1 to 64; ½ per cent bath, 13 tints, equaling about 1 to 48.

Five days after sensitizing:—8 per cent bath, 17 tints, equaling about 1 to 192; 4 per cent bath, 16 tints, equaling about 1 to 128; 1 per cent bath, 15 tints, equaling about 1 to 96; ½ per cent bath, 14 tints, equaling about 1 to 64.

Ten days after sensitizing:—8 per cent bath, fogged and useless; 4 per cent bath, 17 tints, equaling about 1 to 192; 1 per cent bath, 16 tints, equaling about 1 to 128; ½ per cent bath, 15 tints, equaling about 1 to 96.

These results were obtained by development on single transfer paper in water carefully maintained at 120° Fahr., the prints being merely shaken about in the water, not laved or forced in any way, but removed as soon as development seemed complete.

Special Treatment

It must be noted, however, that quite important differences would result from special treatment during development. The lighter tones are relatively more soluble than the darker parts, and may be washed away to a somewhat greater extent by dashing or laving the water over the print, or by prolonged soaking, or by raising the temperature of the water. The difference so obtained is quite perceptible. When the sensitizing bath has been weak — under 1 per cent — violent treatment in development tends to cause uneven action in the more delicate gradations, and simple movement in the water is all that should be attempted.

A little study of the figures given will show that, in cold weather, contrasty prints can be made in carbon from weak negatives which would be unsuitable for even the weakest baths in hot weather.

Summer and Winter Printing

Some makers of carbon tissues recommend a weaker bath in summer than in winter, while others recommend shorter immersion in the bath in summer than in winter, but the variations they suggest, although in the right direction, hardly go far enough. They, of course, refer to negatives specially suited to the normal 4 per cent or 5 per cent bichromate bath. The time

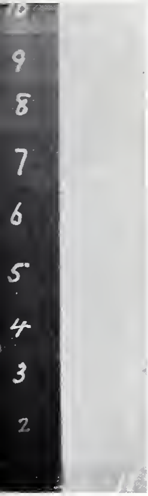


FIG 11

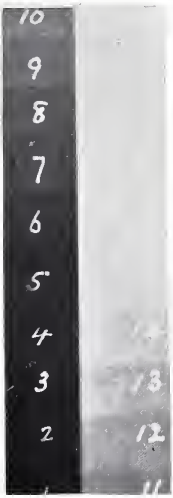


FIG 12

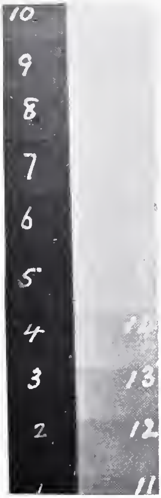


FIG 13

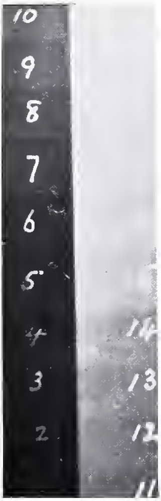


FIG 14

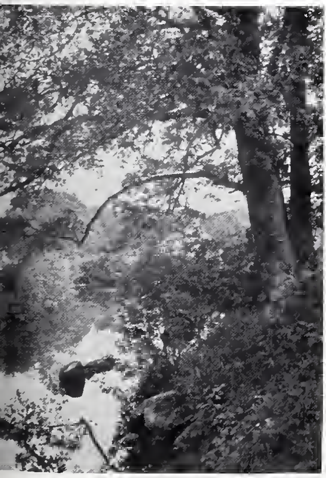


FIG 15

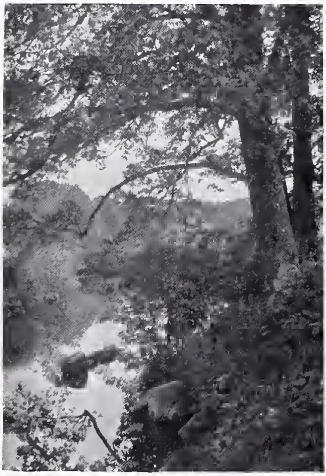


FIG 16

of floating on the bath is most important. Two minutes in summer and three in winter are the times usually recognized as sufficient for full saturation, but it should be noted that shorter immersion is equivalent to using a weaker bath, and gives a correspondingly shorter scale of gradation. In the experiments quoted, three minutes' immersion was given in all cases.

Figs. 11-16

The illustrations, Figs. 11, 12, 13, 14, given, show the scales obtained in summer (average temperature of sensitizing bath 65° Fahr.) on tissue sensitized on ½, 1, 4 and 8 per cent bichromate baths, exposed twelve hours after sensitizing; also prints from the negative previously used to illustrate print-out papers on 1 and 4 per cent tissue, Figs. 15 and 16 showing the increased contrast given by the weaker bath.

Drying and Gradation

The conditions under which the tissue dries affect its gradation; prolonged drying in a cold or damp place will lengthen the scale, and, in the case of the stronger baths, may cause fog. The time should not exceed eight hours.

Carbon vs. Print-out Papers

Comparison with the print-out paper illustrations shows that the gradations of carbon do not fall off at the ends so much, so that it may be used more nearly to its limit without risk of the shadows getting blocked up, also that the half-tones are more vigorous than in print-out papers. It is therefore necessary to use fairly deep tones in the shadows; otherwise the print will have a flat appearance. This confirms the general opinion that carbon tissues "ready sensitized," or used with the normal sensitizing baths, require a stronger negative than print-out papers. When weaker baths are used, of course this rule does not apply, as weak negatives then become available. The darker colored tissues give a great depth of shadow, allowing of strong contrast, but the shades of red and warm browns are more transparent, and yield flatter prints. These differences of color need attention in the choice of tissues for different classes of subjects as well as in the use of negatives differing in quality, influencing results considerably.

DIRECT-PRINTING PIGMENT PROCESSES

Gum bichromate and its congeners do not properly come within the scope of our subject, as it may be assumed that they are seldom, if ever, used by their devotees without some artificial interference with the natural gradation given by the negative. It may be remarked, however, that the depth of shadow will depend on the amount of pigment used in preparing the coating, and the purity of the lights on the kind of paper used. A highly sized paper will tend to give purer lights than a porous paper and, to that extent, a longer range of gradation. There are commercially prepared papers of this class which give quite pure high lights, but under all conditions the character of the process seems to be that the range of gradation is very short, usually about 6 or 8 tones being rendered so that it is not suited for prints showing fine detail. In this respect, however, the results shown by different workers vary greatly, no doubt owing to different methods of working.

PLATINUM PRINTING

Figs. 17, 18, 20 The illustrations of this process show the three brands of paper mostly used in America and Britain. They differ considerably in their range of gradation, the shortest, Fig. 17, having a range of 1 to 128 equal to the longer print-out papers; the others, Fig. 18 and Fig. 20 have a range of 1 to 192 and 1 to over 500 respectively. The latter, which is Kodak Platinum (in America, American Platinum), is remarkable as having the longest scale met with in any printing paper under normal treatment.

Platinum Characteristics Not only because of the long range of gradation, but because also of its character, platinum paper should be used with negatives of strong contrast. The well-marked differences between adjacent tones is very noticeable in the screen-prints, and it will be seen that there is no shading off at either end of the scale. For this reason it is evident that a print in platinum must be a more truth-

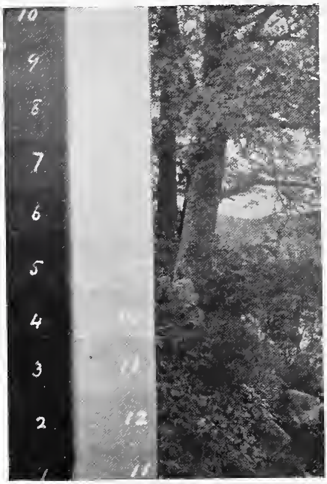


FIG 17

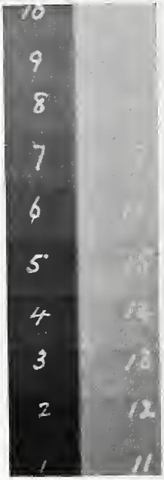


FIG 18

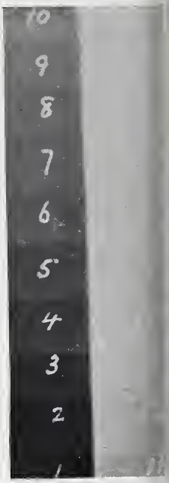


FIG 19

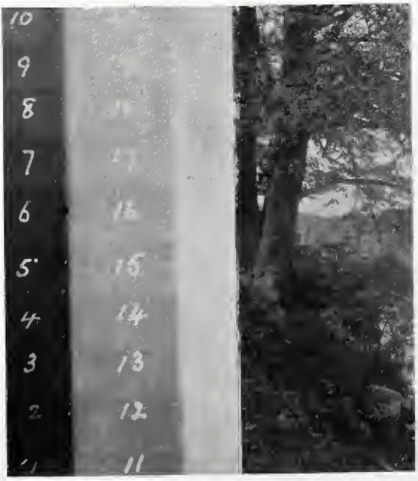


FIG 20

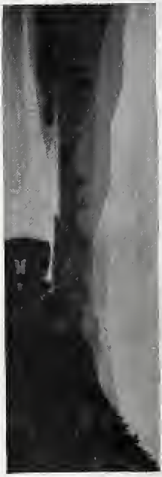


FIG 21

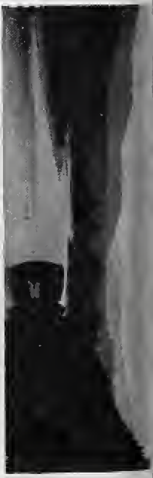


FIG 22

ful rendering of the negative than any other print on paper. It is also evident that the strength of the detail in the lights will give the print a flat appearance unless the negative possesses a fairly dark shadow. Thus the negative used for the illustrations, covering 13 tints of the screen, uses a sufficient amount of the scale in the case of the shortest paper (1 to 128) but not enough in the case of the longest (1 to 500), hence the print on the latter looks weak or flat. Such a paper requires a negative using at least 18 tints or 1 to 250.

Figs. 23, 24

A paper like this is invaluable in dealing with harsh negatives. Thus an example is given in Figs. 21 and 22, where a negative which is really beyond the range of any printing-paper has been used. The print, Fig. 22, shows absolutely no detail in the shadows, being made on the shortest platinum paper, while Fig. 21, made on the longest, shows detail both in lights and shadows. This is an extreme case, and no paper could give a really good print from such a negative.

Varying the Gradation

To a certain extent the gradation of platinum papers may be altered by modifying the developer. Mr. John McIntosh, writing in *Photography* (1905) deals with various methods of shortening the scale. He finds that the addition of 2 to 8 grains of ammoniun persulphate to each ounce of developer is most satisfactory. The effect of 4 grains is shown in Fig. 19 and the lightening of the half-tones is very marked, while the shadows are practically unaffected.

Since there is little or no loss of gradation at either end of the scale, platinum paper may be used almost, if not quite, up to the full extent of their gradation, as the blocking up of shadows which may occur in print-out papers, or indeed in any other kind of print except platinum, does not occur. If, however, the negative used exceeds the limit of the platinum paper chosen, reversal in the shadows will show itself. It shows in the undeveloped print as an apparent bleaching of the deepest shadows, and on development the reversed parts have a rusty appearance. The only remedy seems to be the use of a brand of paper having a longer scale. Certainly there does not seem to be much control in the direction of lengthening the scale, but something may be done by using boiling hot developer as suggested by Mr. McIntosh. It must be noted, however, that the use of developers at high temperatures alters the color of the image, giving brown-blacks which are by no means unpleasing. At temperatures under 60° Fahr. the developer tends to wash away the platinum salts before development is completed and the print assumes a flat, under-printed appearance.

Turning now to the processes used with artificial light, such as

BROMIDE PAPER

we meet with new conditions, as the gradations of these papers vary according to the treatment they receive in exposure and development. A negative when used for enlarging on bromide paper gains thereby a much longer scale of gradation than the same negative yields when used for contact printing, because the scattering of the light passing through the denser parts of the negative, which takes place in enlarging, cannot take place when the paper is in contact with the negative. A negative which is just right for print-out paper is decidedly too harsh for enlarging by artificial light, but may be successfully enlarged by daylight. Even with the longest-scaled bromide papers negatives of not greater contrast than 1 to 40 or thereabout will be found easiest to work, and very much thinner negatives than that will give brilliant enlargements. In contact printing the value of the negative varies also according to the strength of the light and the distance at which exposure is made. Weak light, or long distance from a strong light, give the effect of a denser negative, while strong light is equivalent to decreasing the contrasts of the negative.

Range of Gradation

Bromide papers vary considerably in the steepness of their scale, some attaining greater depth of shadow than others, but on the whole none of them attain such depth of color as a darkly printed print-out or a black carbon print. Compared with these, bromide will be seen to be gray. This may be due partly to the introduction of such substances as starch to produce a dead matt surface, but even glossy bromides do not equal carbon in blackness, the silver being distinctly gray by comparison.

Tested under the screen, when development is carried to its fullest extent, the majority of bromide papers give about 16 tints for rapid papers and 14 for slow papers, equaling opacity gradation 1 to 128 and 1 to 64 so that they do not greatly differ from print-out papers of long and short scale respectively; but it is generally recognized that for the best results the negative should be rather less contrasty for bromide than for print-out paper. This is due to the rapid falling off in the contrast between adjacent tints at both ends of the scale. Differences. especially at the shadow end, are so small that if scattered over a print they would be undistinguishable, therefore the practical length of the scale is considerably shortened. In the longest-scaled brands it does not seem to exceed 1 to 128 or so if the deepest black of the paper is to be used.

Likeness to Plates

The falling off in contrast is due to different causes from those described in speaking of print-out papers. It must be remembered that bromide paper, like bromide plates, has periods of under-, correct- and over-exposure. In the high lights the conditions are those of under-exposure, producing rapid falling off in contrast; in the middle tones, which form the really useful part of the scale, there is the period of correct exposure, characterized by regular increases of opacity; in the shadows the period of over-exposure appears with its characteristic falling off in contrast so that the last few tones are hardly distinguishable. Modification of the developer, leading to incomplete development, alters the scale considerably. A weakened, that is to say a diluted, developer lengthens the scale, provided, of course, development is not continued too long, for ultimately even a dilute developer would give the same reduction as a strong one. By dilute is meant double to three times the quantity of water, and under these circumstances the scale is lengthened to eighteen tints, equaling a negative of 1 to 250. Great dilution—ten to twelve times the water—leads to a condition which Winthrope Somerville describes as incomplete reduction of the silver. Possibly the image then consists partly of Carey Lea's photo-bromide. However that may be, the range of gradation is very great. The color, however, is very bad—a sort of whity brown. By reducing it to haloid and redeveloping with a strong developer, the color is improved to gray, but the scale remains very flat.

Influence of Chromic Acid, etc.

The very remarkable influence of chromic acid or a bichromate on gradation calls for notice. In this country it was first described by Mr. John Sterry, but the discovery is claimed by Professor Namias. Exposure is given sufficient for the highest light, and by treatment with very dilute chromic acid or bichromate solution previous to development the over-exposure of the shadows is corrected. Figs. 23 and 24 show examples of long exposures behind a screen, one developed normally, the other treated with chromic acid 1 in 1,000 for two minutes. The first, of course, shows the normal number of tints for the paper, followed by long tracts of uniform black; the second shows gradation throughout, indicating that it could print from a negative of gradation reaching to thousands—far beyond the possible gradation of any ordinary plate.

Influence of Bromide

Excess of bromide in the developer shortens the scale considerably, but as in the case of plates it must be present from the beginning. Even with amidol, 2 grains per ounce of bromide shortens the scale two or three tints, thus enabling a thinner negative to be used. With a harder-working developer, such as hydrokinone, of course the shortening would be greater still, but it must be remembered that there is a limit to the permissible quantity of bromide, as the color of the image becomes disagreeable when over-restrained. The composition of some developers used for bromide papers rather puzzles one. The idea seems to be to add alkali to make it strong, and then bromide to make it weak. A developer such as amidol, which will work cleanly with little or no bromide, seems more rational, and avoids any shortening of the scale.

It would be superfluous to show prints from differ-

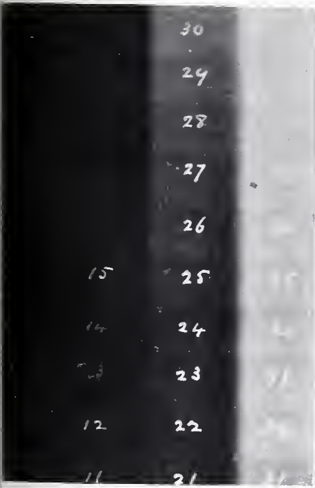


FIG 23

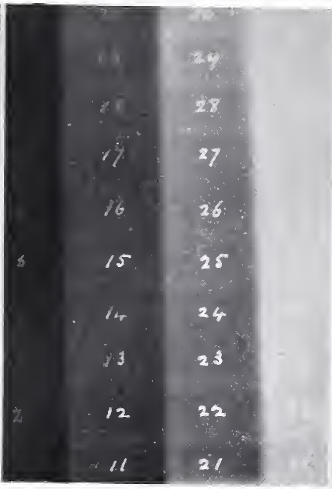


FIG 24

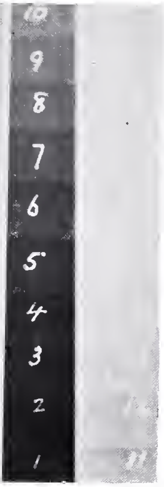


FIG 25

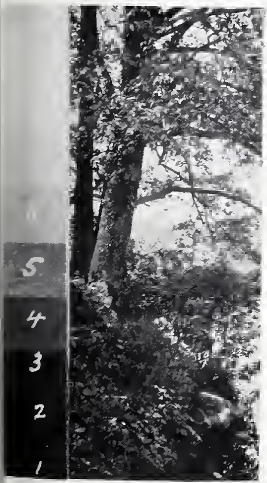


FIG 26

FIG 28

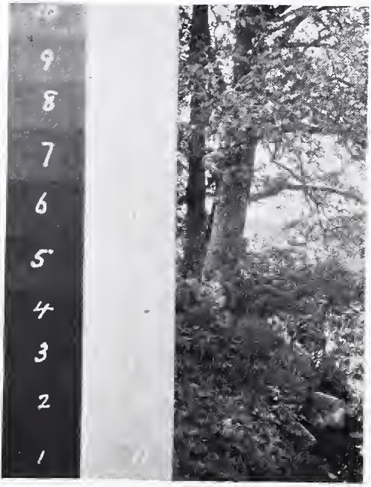


FIG 27

ent grades of bromide paper, as different treatment in exposure and development will give greater variation, with one paper alone, than that obtainable by using long- and short-scaled papers normally. One print on a rapid paper is shown in Fig. 25 for comparison with other processes. The amount of variation resulting from modifications in printing and developing makes comparative tests with any standard screen difficult and of doubtful value.

GASLIGHT PAPERS

These offer a very great choice in the character of the print obtainable from any negative. In the form in which they were first introduced, they had an exceedingly short and steep scale, giving strong contrast with quite weak negatives. These papers are still in use, but they have been succeeded by others giving a much longer scale and suited for normal negatives.

Figs. 26 and 27 show the extremes so far as known to the writer. It will be seen how, using the same negative, the short-scaled paper stretches apart the tones, giving a bright, contrasty print, while the long-scaled paper, which resembles a slow bromide, gives a soft gray print. Between these two, there are numerous brands of paper of intermediate scales.

Variation Difficult

The strength of the light may be varied as in the case of bromides, but very little liberty can be taken with the composition of the developer. Dilution of the developer gives a softer grayer color, but any attempt to increase contrast by using a restrained developer alters the color of the print, usually giving a greenish black.

Over-exposure and restrained development give, with some of these papers, warm colors, but the resulting print tends to be flat.

Figs. 26 and 27

The examples given in Figs. 26 and 27 are normally developed and give gradations of opacity of about 1 to 16 and 1 to 64. In Fig. 26 the paper is not able to deal with all the gradations of the 1 to 48 negative used, and the highest light remains pure white, although the deepest tint of the paper is used in the shadows.

CLASSIFYING NEGATIVES

A Ready Method

To actually test the range of opacity gradation in a negative is a tedious task, not likely to be undertaken by many readers. A closely approximate idea of the values of a negative, however, may be formed by making a good print from it on, say, print-out paper, and, when the print is properly finished and dry, cutting out the highest light and the deepest shadow. Then having made a print on the same paper under the testing-screen and toned and finished it together with the other, the cut-out pieces can be compared with the tints on the screen-print. If the screen has been tested so that its gradations are known, the amount of contrast in the negative can be at once read off by noting the number of tints used in the screen test. Thus the negative mostly used in preparing the illustrations in this book uses 13 tints, and in the screens also used 13 tints equal a range of negative opacities of 1 to 48, therefore that is the extent of the contrast in the negative.

Supposing, however, that the reader has not troubled to test his screen, but uses it merely to judge the quality of a paper by the length and steepness of its scale. In this case the comparison suggested above will still be useful. Suppose the screen-print shows several tints either darker or lighter than the tints used by the negative, it is evident that the full capacity of the paper is not used by that negative, therefore the negative has not sufficient contrast to give a rich full-scaled print on that paper, and a paper of shorter and steeper scale will probably give more pleasing prints. On the other hand, if all the tints are used up and the shadows have a heavy blocked-up appearance, better results will be obtained by using a paper, or a process, giving a longer scale of gradations.

Standard Negatives for Comparison

The inexperienced photographer will find it useful to prepare a set of standard negatives with which he can compare his every-day work, and this can easily be done by *exactly* repeating the following experiment. Find a subject containing a pure white object and a deep shadow. The writer used a clean lime-washed cottage on the edge of a dark wood, a subject which may not be everywhere available, but a little ingenuity will replace it by a subject showing a white sheet in sunlight and a black fabric in shadow. Choosing a time when steady sunshine is falling on the white object, expose half a dozen plates, using a shutter adjusted to give equal exposures.

Plates and Developer

The plates must be "Seed 27 Gilt Edge" which were chosen as being obtainable on both sides of the Atlantic. The experiment should be made at a season when the temperature in the developing room is as nearly as possible 65° Fahr. and the developer must be kept in the room 12 hours so as to insure its having reached the same temperature. The developer to be used is to contain in each ounce of water, 2 grains of pyrogallol; 12 grains of sodium carbonate (recrystallized); and 12 grains of sodium sulphite (crystals), the pyro being added just before use, and *no* bromide used.

Development

Note the time of pouring on the developer and cover the dish, then exactly two minutes after pouring on remove the plate, rinse quickly, and fix. Repeat the operations,—with equal care,—with each of the other plates, increasing the time of development exactly one minute each time. Provided the sulphite has been of good quality, the negatives will be of a slightly olive tint with clean unstained shadows. Two minutes' development has been just sufficient to give all the details in the shadows, and the first negative, developed for that time will be a thin, delicate one, capable of giving vigorous prints on slow gaslight papers, soft prints on the more rapid papers of that class, and on slow bromide papers; it will also give good bromide enlargements by the weaker artificial lights, such as oil or Argand gas.

It is, of course, assumed that proper exposure has been given to secure the gradation of intensities in the subject, and on that point full instruction has been given in former numbers of THE PHOTO-MINIATURE, as in Nos. 56 and 66.

Negative No. 1 This negative will have a difference of opacity between the white object and the deepest shadow, of about 1 to 16, perhaps a little more; depending on the promptness with which it has been removed from the developer.

Negative No. 2 The 3-minute negative will have nearly double the contrast, say about 1 to 30, and will be suitable for the steeper print-out papers and for carbon with weak sensitizing baths (about ½ per cent) freshly sensitized, also for enlarging by incandescent gas light.

Negative No. 3 The 4-minute negative, having a range of about 1 to 60, is a good all-round type suitable for the great majority of print-out papers, for carbon with 2 to 3 per cent baths, freshly sensitized, also for the shorter-scaled platinum papers, and for enlarging by daylight and the most powerful artificial lights such as lime light or arc light

Negative No. 4 The 5-minute negative has a contrast range of about 1 to 120 giving "brilliant" prints on print-out papers of the longest scale, and is suitable for the longer-scaled platinum papers and carbon with 4 to 5 per cent sensitizing baths, freshly sensitized. It is, however, apt to give harsh results in enlarging unless with special treatment of the bromide paper in development.

Negative No. 5 The 6-minute negative will have a range of gradation 1 to about 200 and is a type of negative that is not desirable, being too hard for all but the longest-scaled platinum papers or carbon tissues sensitized with concentrated baths. Contact prints may, however, be made from such a negative on bromide paper with special treatment.

Experienced photographers will, of course, recognize that the above classification applies to what may be termed normal printing. There is nothing to hinder the softest negative from being employed with the softest-printing paper, or vice versa, if it suits the taste of the worker, or gives the special effect he aims at. If this book serves any purpose at all, it is to show that in attaining special effects in one's prints there is as much latitude in the choice of a printing-paper as there is in

About Development

In making the above series of negatives the principle of time-development has been followed, and its efficacy in yielding negatives of known contrast and of uniform quality must be admitted. The one objection that seems insuperable is that the great majority of photographers have no means of regulating the temperature of their workrooms and solutions, yet uniform temperature is the very essence of the system. Factorial development, to a great extent, eliminates this difficulty, provided exposure has been reasonably correct. Both systems are fully dealt with in THE PHOTO-MINIATURE No. 66. The "time of appearance" in the above experiment was twenty seconds, so that the factors were 6, 9, 12, etc.

Pyro Stain

Pyrogallol remains the favorite developer of probably a large majority of photographers, but it has one grave defect, which, unless care be taken, makes it impossible to obtain negatives of known and pre-determined contrast. This is the well-known "pyro stain,"—not the general stain affecting the clear parts of the negative, which no careful photographer need ever have,—but the graduated stain forming part of the image. This is formed as an essential product of the action of development unless sulphite is present in sufficient quantity to remove it as it forms. That this stain has a decided influence on the printing gradation of the negative is shown by the accompanying print (Fig. 28), from a graduated negative from which all silver has been removed, the print being entirely due to the residual pyro stain. Many photographers have a prejudice in favor of this stain, believing that it improves the quality of the prints. Be this as it may, it is beyond dispute that the quantity of sulphite present determines the amount of the stain and that, as the sulphite becomes oxidized in old stock solutions, the stain increases. Therefore, if there is to be any accurate knowledge of the gradations of negatives the amount of stain as well as the time of development must be regulated, and that can be done only by using solutions made up at the time of using, or by using a non-staining developing agent.

The Choice of a Printing Paper

BY T. THORNE BAKER

A very great deal is written about the gradation of the negative, and what its character should be in order to yield a good pictorial print; but the authors of such articles are apt to forget that the character of the negative is like one party to a bargain,—unless the class of printing-paper to be used subsequently be borne in mind, it is of very little use aiming at any special result in the negative.

If you had three circles on a piece of cardboard, and shaded them with a pencil so that one, which we will call A, was twice as dark as the next, B; and B was twice as dark as the third, C; i. e., the amount of light reflected from A was twice as much as the light reflected from B, etc.; then if your print is to be a faithful rendering of the original subject, the circles must be represented in it so that A is twice as bright as B, and B twice as bright as C. But do not for one moment think that to get this result the circle A should be doubly as dense in the negative as B, and so on. This will depend entirely on the character of the printing-paper you use. For instance, print-out paper gives us an image inclined to be harsh, but a softer print may be had from the same negative if printed in direct sunlight instead of in the shade. Gaslight paper, such as contrasty Velox, gives an even greater amount of contrast and a shorter scale of gradation. This may, of course, be remedied by using a gaslight paper prepared to give soft prints. Most bromide papers require a plucky negative in order to yield a rich, contrasty, vigorous print; platinotype is very much the same and usually less controllable than bromide paper. Gum and carbon printing-papers want a soft, delicate negative, with the deepest shadows degraded in the negative, etc.

How to Choose I shall, therefore, try to show, in the following paper, how to choose a suitable printing-paper in order to get a definite result as regards gradation from any given negative and how, further, one can often modify developer, toner, or method of exposure in order to be able to use a desired paper which might otherwise prove unsuitable.

Classifying Negatives It will be necessary to roughly divide up all negatives into three classes—over-exposed and flat ones, those which may be looked upon as correctly exposed and developed and of medium contrast, etc., and those which, through under-exposure and subsequent forcing in development, are harsh, of the "soot and whitewash" variety. I will assume also that the reader has, in every case, developed his plates with the idea of getting as good a negative as possible rather than of adapting their character to any special pictorial effect. We have thus to consider how to get a soft, well-graded or contrasty print from these three classes of negatives.

Print-out Papers Taking print-out paper first, we find that a very fair print can be had from almost any negative if we give it the right treatment in printing. It is a general rule that with all printing-papers, the softer the light and the longer the exposure in consequence, the more vigorous will be the contrasts in the print. Hence, dense or harsh negatives should be printed in direct sunlight, weak or flat negatives in the shade, and very thin negatives in the shade also, using a piece of thin tissue-paper pasted over the frame to still further soften the light. Tissue-paper should not be placed in contact with the glass side of the negative, as this is liable to produce a mottled effect due to the structure of the paper.

Differences in Papers The observant reader who has tried more than one brand of print-out paper will have noticed that some papers print out much bluer than others, some giving a distinctly red image. The bluer the image, the more silver nitrate there is in the emulsion, and the less organic silver salts. The latter are productive of half-tone and gradation, whilst print-out paper rich in free silver nitrate gives a harsh image. It is thus a good plan to keep handy both varieties of papers and to use the bluer-printing paper for weak negatives, and the redder one for dense or harsh negatives. But papers which print out a blue or purple color always require carrying *deeper* than the others, as they lose much more, comparatively, in the after processes, and both varieties should have an extra-deep printing whenever the combined bath is to be used.

Helping Under-exposed Shadows

Sometimes with an under-exposed negative the shadows are almost like clear glass, but nevertheless possess very faint details, which are lost owing to the over-printing they necessarily get. One can often improve matters by dabbing (in a sort of fine stipple) a little yellow or pink medium over these "clear-glass shadows," on the glass side of the negative, but care must be taken to diffuse the edge of the patch well so that it does not show in the print. A little carmine water-color, mixed with gum or weak hot gelatine solution, will answer the purpose. Another method sometimes resorted to is to matt varnish the glass side of the negative altogether, and to shade over with pencil any faint portions of the negative, as the varnish when dry gives a good surface for the pencil.

Toning Hints

The toning of print-out papers requires consideration, and altogether too little thought is given to this matter as a rule. If you had two prints divided into strips, each of which was double as dark as the preceding one, and one was toned a warm red, the other a pure black, the gradation would seem softer in the warm print than in the other. For this reason you will find that a warm-toned print almost invariably gives a more harmonious and artistic picture than a purple or blue print. Warm tones are readily enough obtained by using a weak toning bath, about a grain of gold to 12 or 16 ounces of water and sufficient bicarbonate of soda to just neutralize the acidity; or a sulphocyanide both containing 30 grains of the ammonium salt and 2 grains of gold chloride to 20 ounces of water. The final color can be approximated by looking through the prints, and when a warm sepia tone has been reached, they should be well rinsed in water and then fixed. With some papers an intermediate bath containing about a grain of sodium sulphite to the ounce of water is used, as this at once stops the toning action at any desired point.

Bromide Papers

Considering the pleasing sepia and warm black tones which can be had on bromide paper by the very simple sulphide toning methods, bromide paper really seems worthy of the closest study. As we will see, with a good brand of paper, there is no difficulty in getting any kind of gradation desired, the latitude in exposure and development for varying treatment being enormous. Whether one wishes to modify the gradation in order to suit the negative, or to get pictorial effect, it is essential to *know the paper*, i. e., its elasticity so to speak; and to do this, I strongly recommend taking an average negative, exposing several pieces of the paper under it for the same time, and then developing them with varying quantities of the two solutions given below. By splitting up the antiquated single-solution metol-hydroquinone developer into two, and varying the relation between metol—the gradation giver—and hydroquinone—the contrast giver—we can obtain the extremes as regards gradation from almost any negative, and therefore the intermediate classes of gradation as well.

The Developer

Here are the two formulæ: A.—Water, 10 ounces; hydroquinone, 52 grains; potassium metabisulphite, 18 grains; sodium sulphite, 5 drams; sodium carbonate, 1¼ ounces.

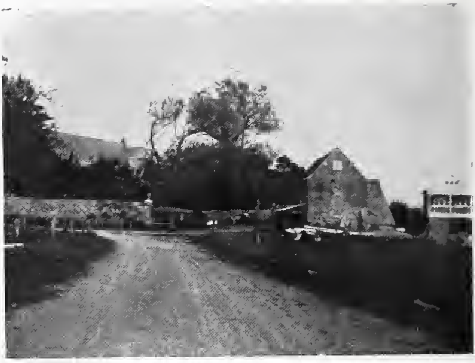
B.—Water, 10 ounces; metol, 30 grains; sodium carbonate, 5 drams; sodium sulphite, 5 drams. The reader must be guided by the class of bromide paper he uses, as well as the negative, as to whether bromide be used. One or two drops of a 10 per cent solution added to one ounce of mixed developer will materially increase the contrast and may be necessary with some papers to ensure purity of the whites.

Putting aside bromide, however, it will be found that two parts of B and one of A give beautiful gray prints, with maximum half-tone and gradation, and this mixture is suitable for harsh, vigorous, contrasty negatives. Equal parts of A and B give excellent prints from a normal negative which is itself well graded and fully exposed; whilst two parts of A and one of B will yield a rich, vigorous print from a soft, delicate negative, or a contrasty print from a plucky negative.

Example Three prints from the same negative, with the same exposure, are shown in the accompanying figure, developed with the above-stated mixtures respectively. By varying the proportions of A and B still further, any imaginable amount of hardness or softness is obtainable, on the following scheme: If harshness is wanted, or contrast from soft negative, use more of A, less of B. If ordinary vigor is wanted from a very flat negative, use the same mixture plus bromide. For a normal print from a normal negative, use equal parts of A and B. If softness is required, use more of B and less of A.

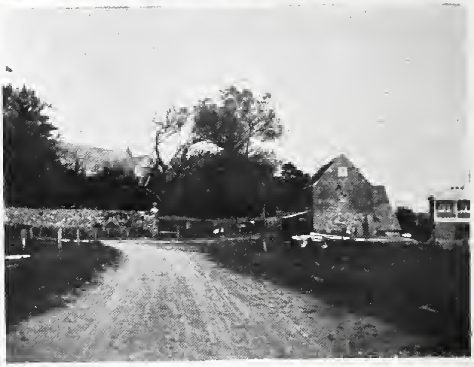
Distance from Light The strength of the illumination makes a considerable difference in the character of a bromide print, a long exposure some distance from the light giving much more vigor than a rapid exposure close to. This fact may frequently be taken advantage of when a certain class of gradation is required. But although this is a fairly general rule, varying the distance of the printing-frame from the light does not produce as much difference with some papers as with others, simply because some papers have not the power to give a deeper black than some given black, i. e., their gradation capacity or scale is limited, as Mr. Goodwin has explained in detail. Weak emulsions or thinly coated paper are the cause of this.

If you want a fairly rich print from a negative of medium gradation, do not have the frame less than two feet from a No. 5 gas burner, or three feet from a 16 c. p. incandescent light. Of course, if you want a well-modulated bromide print from a dense, harsh negative, hold the frame as near as four inches from the flame. Use a standard light in your early experiments and a two-foot rule to measure the distance; a few notes jotted down recording your results will show what control is given over the gradation by these variations.



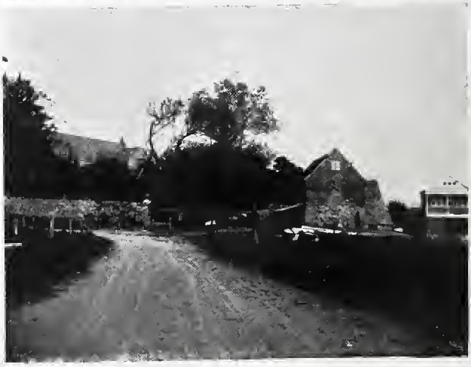
A

Normal negative. Bromide print developed with the metol solution alone—soft.



B

Same exposure as A: developed with 3 parts of metol solution and 1 part of hydroquinone.



C

Same exposure as A: developed with 1 part of metol solution and 3 parts of hydroquinone.

Illustrating article by T. Thorne Baker

Amidol for Rich Blacks

Those who like blue-black prints, in which perhaps we get the richest possible blacks, should try amidol, but it *must* be freshly prepared. The following formula is reliable: Distilled (or boiled) water, 4 ounces; sodium sulphite (crystals), 90 drams; amidol, 10 to 15 grains. Add a drop of 10 per cent bromide solution to each ounce of developer.

Here again we may increase the richness of the prints by increasing the amidol, but there is nothing like the control one gets with the metol-hydro in two solutions.

Sulphide Toning

The esthetic photographer is sometimes inclined to throw away a really good bromide print because the black tone is too harsh and crude to suit the subject. Let me recommend for such prints a very slight treatment with the sulphide toner, which will impart a warm chocolate-brown tone to them, softening the gradation and giving a harmonious quality, while retaining all the richness desired in such prints. Half a dram of potassium ferricyanide in an ounce of water forms the *bleacher*. Twenty grains of sodium phosphate in an ounce of water forms the toner. The method is simple. First wash the prints; then soak them for twenty seconds to one minute in the bleacher; again wash until the whites are pure; then put them in the sulphide toner for a minute or two; finally wash and dry. Longer bleaching gives warmer colors.

Gaslight Papers

Gaslight papers give very little control over the gradation of the print, for the very simple reason that in the proper development of the paper the total effect of exposure is developed; neither an under- nor an over-exposed print is any use, and hence we are obliged to fly to the papers which are specially made to give soft results when we want softness. Gaslight papers come in very useful when we cannot get a sufficiently vigorous print with anything else, but they should be placed fairly near the source of light, as, if at all under-exposed, they are too harsh and crude to be of any use. Amidol and metol-hydroquinone are here the most useful developers, but there is practical wisdom in using the developers specifically made for special papers, as the composition of the average gaslight paper is peculiar to itself and the balance is easily disturbed by experimenting with a variety of developer formulæ. Nothing seems to replace metol-hydro for certainty of results.

Carbon Prints

Carbon printing is a method beautifully adapted to negatives of widely different character or for obtaining different sorts of prints, because of the infinite variety of colors in which it may be worked. As Mr. Goodwin shows, the range of gradation varies according to the strength of the sensitizing bath employed, so that in this modification we have a means of adapting the paper to the kind of negative in hand or the result in view. A fairly normal negative will give a plucky image in carbon. A well-exposed negative, developed so as to get out all the details without incurring great density, and in which the lightest lights are just degraded, will give the most perfect print, unless some subtle effect is aimed at.

Bennett's Formula

The strength of the sensitizer and its composition are of great importance, and I recommend without hesitation the formula devised by Mr. H. W. Bennett, as follows: Potassium bichromate, 4 drams; citric acid, 1 dram; strong ammonia water, about 3 drams; water, 25 ounces.

The potassium bichromate and citric acid should be dissolved in hot water, and sufficient ammonia added to change the orange color of the solution to lemon-yellow. Ninety seconds is the time given for sensitizing. Reducing the amount of water in the solution to say 20 ounces, *softens* the gradation in the print; increasing it to something like 30 ounces gives more vigor. But remember that carbon is primarily a *short gradation* process, so that a stronger bath is usually best for the negative of medium contrast and density.

It is hardly necessary to observe that those who seek to produce a certain artistic effect as regards gradation will probably know how to develop their negative in the first instance, in order to—taking full advantage of the scale of carbon tissue as they work it—produce that effect. But those who seek a scale of gradation in a print different from that which the process will yield with a given negative will be glad to avail themselves of the fact that a stronger sensitizing bath means softer prints, and over-exposure within reasonable bounds means the same. Immense control can of course be obtained in carbon and gum printing by local treatment with hot or warm water, using a spray of water to thin down the parts it is desired to reduce.

Platinum Paper

Lastly, we come to platinum paper, for which the beginner is usually advised to use "plucky" negatives. This means that it is inclined to give rather softer gradation than that of the negative. With a fairly soft negative, however, platinotype gives exquisite results in portraiture, and the masterpieces of Hollyer and others have been produced from negatives which have had sufficient exposure and development to give a tolerably dense negative possessing a very wide range of tone, or softness of gradation.

According to recognized authorities on platinum printing, it is possible to control the gradation in print according to the following simple method: If you want increased contrast, do not print too deeply, develop with cold developer, and subsequently intensify the print with platinum. If you want increased softness, use hot developer, and first let the printed paper become moist with the steam of the hot solution.

Summing up all that has been said in the foregoing article, we shall find that where we want the same gradation or thereabouts in the print which the negative itself possessed, we can use bromide paper, often carbon, and often platinotype, whilst P. O. P. also can be modified in printing to suit it, provided it be not too dense. In all known cases softening or lessening the light and increasing the exposure therefor, we get increased contrasts; whilst quick printing in a strong light lessens contrasts. Warm tones as a rule lengthen the scale of gradation, and in bromide work a large proportion of metol will do the same. For weak or flat negatives a contrasty gaslight paper is the best to use if steeper gradation is wanted in the print. Finally, practically all other processes can be more or less modified in the ways indicated to give the gradation desired.

Notes and Comment

The next number of THE PHOTO-MINIATURE will deal with the choice and use of lenses in photography with special reference to hand-camera work, replacing Nos. 1 and 36 of the series, long out of print. The introduction of new lenses, and the increasing use of anastigmats with hand-cameras, have resulted in a widespread demand for information on the subject. THE PHOTO-MINIATURE No. 79, will endeavor to cover this field in a very plain and practical way. Unless some unforeseen circumstance should prevent it, the number will be published about the middle of April.

THE PHOTO-MINIATURE should be readily obtainable from any photographic dealer, kodak agency, bookseller or news agent in the world. Readers unable to get the magazine from their local dealers can confer a favor by advising the publishers, Tennant & Ward, New York, for the United States and Canada, or Dawbarn & Ward, Ltd., London, for Great Britain, Australasia, India, etc.

❧

Owing to the pressure of important papers, we are again obliged to lay over many notes concerning new commercial specialties, new books and prints, catalogues and the like. These will be given as quickly as we can make room for them in forthcoming numbers. As it is, we are exceeding the practical limit of cost in making the magazine, our last issue containing 72 pages of text instead of the usual 48 pages. In view of the increasing cost of production: paper, printing and other expenses, this larger bulk brings up serious problems.

❧

An exhibition of the work of Alvin Langdon Coburn will be held at the Little Galleries of the Photo-Secession, 291 Fifth Avenue, New York, opening March 11 and closing April 10.

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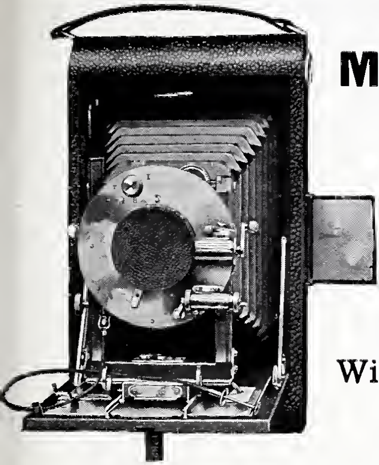

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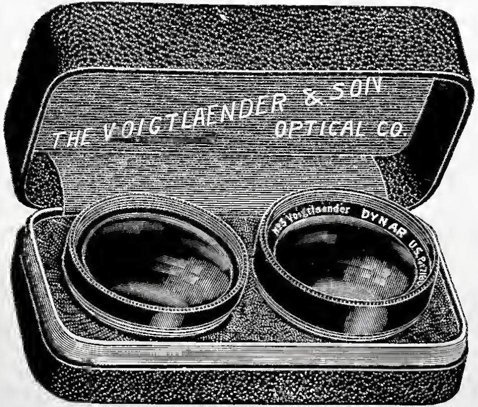

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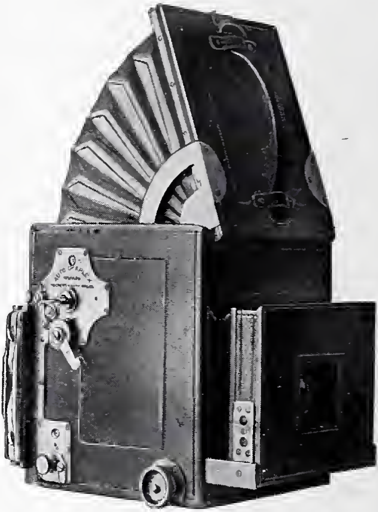

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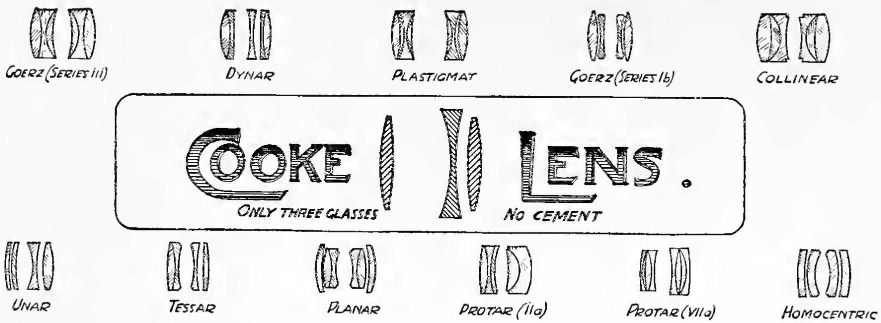

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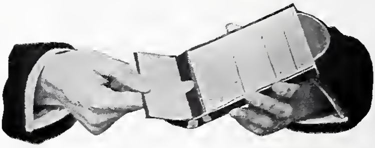

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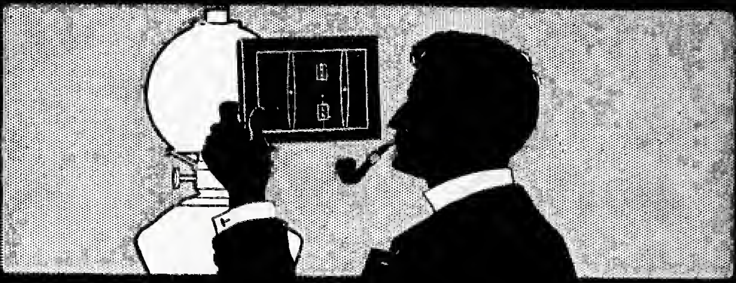

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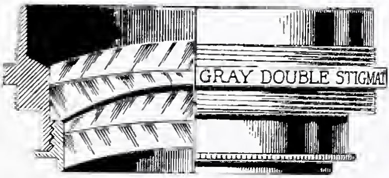

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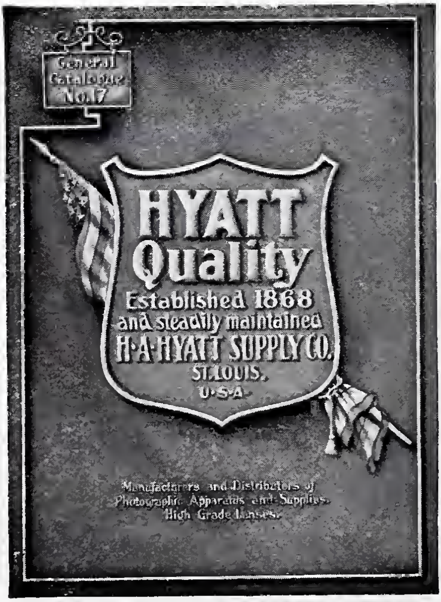
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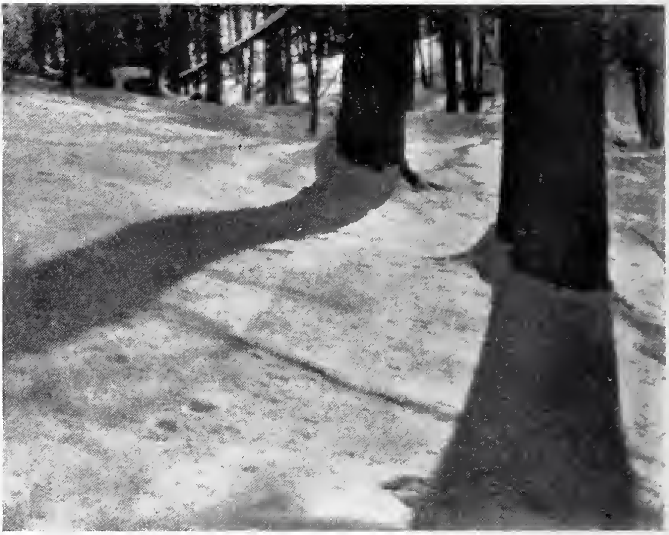

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The Photo-Miniature
A Magazine of Photographic Information
EDITED BY JOHN A. TENNANT

Volume VII MARCH, 1907 Number 79

The Choice and Use of Lenses

The amateur's first lens usually comes with an inexpensive camera and, if considered at all, is thought of simply as a necessary part of the outfit for making photographs. So long as the camera is used merely to fill out the idle hours of an occasional bright day out-of-doors, everything is satisfactory; but when serious work is attempted, first one thing and then another brings out the fact that the practical efficiency of the equipment depends upon the lens and the photographer's knowledge and use of its capacities. Therefrom arise two desires: first, to know more about the lens; and second, to get a "better" lens. It is here that all the questions about the lens have their source and beginning. Then follow inquiries and comparisons among fellow amateurs; quiet but perplexed hours spent with text-books and lens catalogues; consultations with friendly dealers, editors or other reputed authorities—until the second lens is purchased, the result of much careful thought and investigation along special lines. Happy is the amateur who finds his desires reasonably fulfilled in this second lens, and seeks no further than to learn its uses and limitations in his field of work. Generally, however, this first serious inquiry in the subject of lenses breeds eternal unrest and an insatiable desire for change: upon which sure foundation lens-makers all the world over are building the enduring monument of their abundant prosperity.

Where Difficulties Arise

As far as my experience goes, there is no finality in the amateur's quest for lens information. One question leads to another, and answers beget still other questions. But this much seems to be clear, that most of the amateur's lens difficulties come from: (1) his inability or reluctance to recognize the inherent limitations of lenses, and (2) his attempts to reconcile hearsay and text-book information about lenses in general with the carefully worded descriptions of particular lenses given in the trade catalogues from which he buys. Profiting by this experience, I venture to abandon the usual method of treating the subject, and propose to deal with the practical properties of lenses as bought and sold rather than with text-book theories. A few elementary notions of the lens and its work must, of course, be assimilated before we can intelligently discuss the choice and use of lenses for different kinds of work; but this theoretical part will be treated as briefly as possible. In this way I hope to enable the reader to recognize the varied capacities and limitations of lenses, half-hidden, half-revealed in the trade catalogue descriptions, and so help him in the intelligent choice of that "better" lens of which, perchance, he dreams.

The Function of the Lens

First let us make sure about the work which the lens has to do—its function—in photography. The peculiar usefulness of photography lies in its capacity to truthfully represent natural objects, both as regards delineation and light and shade. In this making pictures of things, the first essential step is the formation of an image of the object upon the sensitive plate or film in the camera. How do we form the visual picture-images of the things we say we see? Let us consider all visible things as bodies whose surfaces are made up of an infinite number of luminous points, with every point reflecting light in all directions by means of what we call light rays. These light rays, proceeding from every luminous point in an object, bear images of the points from which they are reflected. When we look at any object, the eye intercepts or collects these image-bearing rays, condenses them to corresponding points and rearranges them upon the retina, thus forming an image of the external object within the eye—each point in the image so formed being a counterpart of a corresponding point in the object.

The Pinhole Image

The simplest means of obtaining such an image in the photographic camera is to make use of a minute aperture or pinhole. If we set up a camera on its tripod facing any well-lighted object out-of-doors and, in the front of the camera usually occupied by the lens, fix an opaque shield of very thin metal or card pierced with a needle (thus forming a needle aperture or "pinhole"), we will see on the ground-glass focusing screen a true (though inverted) image of the object or scene in front of the camera. This method of forming and projecting picture-images is the basis of "pinhole photography," which is fully described in THE PHOTO-MINIATURE Nos. 27 and 70.

Its Qualities and Defects

An hour or two spent out-of-doors with a pinhole camera will show that the pinhole has many advantages and is capable of producing very pleasing pictures. It gives images free from distortion, reproducing straight lines as straight lines and rectangles as rectangles. It reproduces near and distant objects with an equal degree of sharpness of definition, so that we say that the pinhole has unlimited depth of definition. It is limited in angle of view or amount of subject included only by the size of the plate used. It gives practically equal illumination and equal definition from the center to the edges of the plate, so that we say that the pinhole has perfect covering power, and so on. A more critical examination, however, brings out two very distinct defects or disadvantages, which practically destroy the usefulness of the pinhole for every-day photographic work. The pinhole is incapable of producing a sharply defined image. There is fair, soft definition everywhere, but no matter how we increase or decrease the distance between the focusing screen and the pinhole, we cannot bring the image-bearing rays to small or precise points, upon which the obtaining of a sharply defined image depends. The pinhole also lacks rapidity. Because of its small area it can pass very few rays to the focusing screen or image plane, giving a feebly illuminated image, so that prolonged exposures are necessary to impress even the most sensitive plate or film. In modern photography these two qualities are of supreme importance. We must have the ability to produce sharply defined images when desired: and, since many of our subjects include movement, we must have the power to impress the picture-image upon the sensitive film with short exposures.

The Lens

These essential requirements are fulfilled by the lens. Briefly described, the photographic lens is a disc or series of discs of glass with highly polished surfaces, at least one of which is curved or spherical in form. By the properties of the glass used and the construction followed, the lens is designed to collect as many as possible of the image-bearing rays reflected from the luminous points in an object in front of it, and to converge these rays to corresponding points, thus forming a real image of the object—in which image every point is a representation or counterpart of a corresponding object point. This vital capacity of the lens, its ability to converge image-bearing rays proceeding from luminous object points to corresponding image points, is known as its defining power. The image so formed is projected in an aërial field behind the lens, commonly called the image plane. By placing a ground-glass screen in this image plane (where the image-bearing rays are brought to points or "focused," as we express it), the image is made visible and we can judge of its qualities as a representation of the object before the lens. By its larger area—greater light-collecting and light-transmitting capacity—the lens is capable of giving a much more brilliantly illuminated image than can be obtained with a pinhole. This greater light intensity of the lens, resulting simply from its capacity to pass a considerable volume of light to the image plane as compared with the pinhole, constitutes its "rapidity" and makes possible the short exposures required in many branches of photographic work.

Things to Remember

So much for the lens and its function. The two things to be remembered here are: (1) the quality of a lens depends upon its defining power, i. e., *the accuracy with which it* *brings to points* the image-bearing rays which it collects and transmits; and (2), the "rapidity" of a lens depends upon *the number of rays brought to these image points.* We note, in passing, that of two lenses equal in defining power and rapidity, the lens which will define the larger angle (greater width of image) is the better one. For example: the great superiority of the anastigmat over the earlier rectilinear lies wholly in its ability to produce sharply defined images over a large area combined with great intensity or rapidity.

Advantages and Limitations

By the use of the lens, then, in place of a pinhole for the formation and projection of the picture-image we gain: (1) the ability to produce sharply defined images of objects, and (2) more brilliantly illuminated images, which spell rapidity. Unfortunately, together with these advantages, the lens has peculiar limitations. These result from what are known as the five aberrations or errors of the lens, which have their origin in the nature of the material (glass) of which the lens is made, and the essential condition governing its form, i. e., that the surfaces of the lens are always spherical or are considered as such. These errors are: *spherical aberration*, *chromatic aberration*, *distortion*, *curvature of field*, and *astigmatism.* Some lens-makers add *zonal aberration* or *coma*, formerly known as oblique spherical aberration. Apart from these errors, which belong to the lens because it is a lens, a lens may have certain defects such as striæ, flare spot, etc. This list doubtless looks somewhat formidable to the gentle reader, but, as all the errors are referred to in lens catalogues, we cannot do better than consider them as briefly as may be.

The Significance of Errors

Their importance lies in the fact that they, one and all, interfere with the vital capacity of the lens—its defining power. They present special difficulties when the attempt is made to combine defining power and rapidity, the two qualities most desired in a lens. Hence the money value of a lens, as seen in the trade catalogues, is in direct ratio to the claims made as to the elimination or correction of these aberrations. For example: We are offered the useful little No. 2 Brownie, fitted with a "fine meniscus lens," for two dollars, while the Goerz Pantar, listed for the same size plate, but catalogued as "perfectly rectilinear and completely corrected for spherical, chromatic, astigmatic and comatic aberrations, etc.," sells at forty-nine dollars without camera or other accessories. As it is impossible to grasp the significance of these aberrations and their correction without some knowledge of the make-up of the lens, we must glance at this before going further.

The Make-up of the Lens

First, as most of us know, the photographic lens is not a single piece of glass, but is always made up of two or more glasses or "simple lenses," as they are called. It is the existence of the errors mentioned in the simple lens which makes this use of several glasses necessary. These simple lenses are divided by lens-makers into two distinct classes, viz., *positive* or convergent lenses, which are thicker at their central part than at their margins and converge or bend inward to points (bring to a focus) parallel rays passing through them, thus forming images; and *negative* or divergent (sometimes called *minus*) lenses, which are thinner at their central part than at their margins and diverge or bend outward the rays passing through them, so that they cannot form images. Just as positive and negative lenses are opposed in character, so they possess opposite aberrations, positive lenses having positive aberrations and negative lenses having negative aberrations. This condition offers great advantage in the correction of lenses, so that by combining simple lenses having opposite errors the negative aberrations of the one may be utilized to reduce or eliminate the positive aberrations of the other. A glance at the diagrams of lenses given in the lens catalogues will show many different forms of simple positive and negative lenses combined in many different ways, but the end in view is always the same; viz., the elimination or correction of these troublesome errors or aberrations. Since photographic lenses have to form real images, the simple lenses of which they are made up are always chosen and combined in such a way that the resulting combination is convergent in character, i. e. having the ability to converge image bearing rays to points.

Refraction and Dispersion

Again, simple lenses, whether convergent or divergent in character, possess in common different powers or properties according to the kinds of glass used, their thickness and the curvature of their surfaces; (1) to bend aside (or refract) to different degrees light rays passing through them, and (2) to separate (or disperse) and bend aside to different degrees the several colored rays which make up a ray of what we call white light. These properties are coexistent but separate and distinct in the lens. *Refraction* refers to the bending of the light ray as a whole; *dispersion* refers to the separation and bending aside of the various color rays composing the white ray. Thus lens glasses are spoken of as of high or low refractive and dispersive powers according to their properties in these respects. Similarly, a single variety of glass may possess high refractive and low dispersive powers, or contrariwise. All this is somewhat bewildering at first sight, but will be made clearer as we go along. It is sufficient to note here that simple lenses have these properties, and that they are utilized in the correction of the lens so that it will give critically sharp images over a large area when used at its full aperture.

About Light Rays

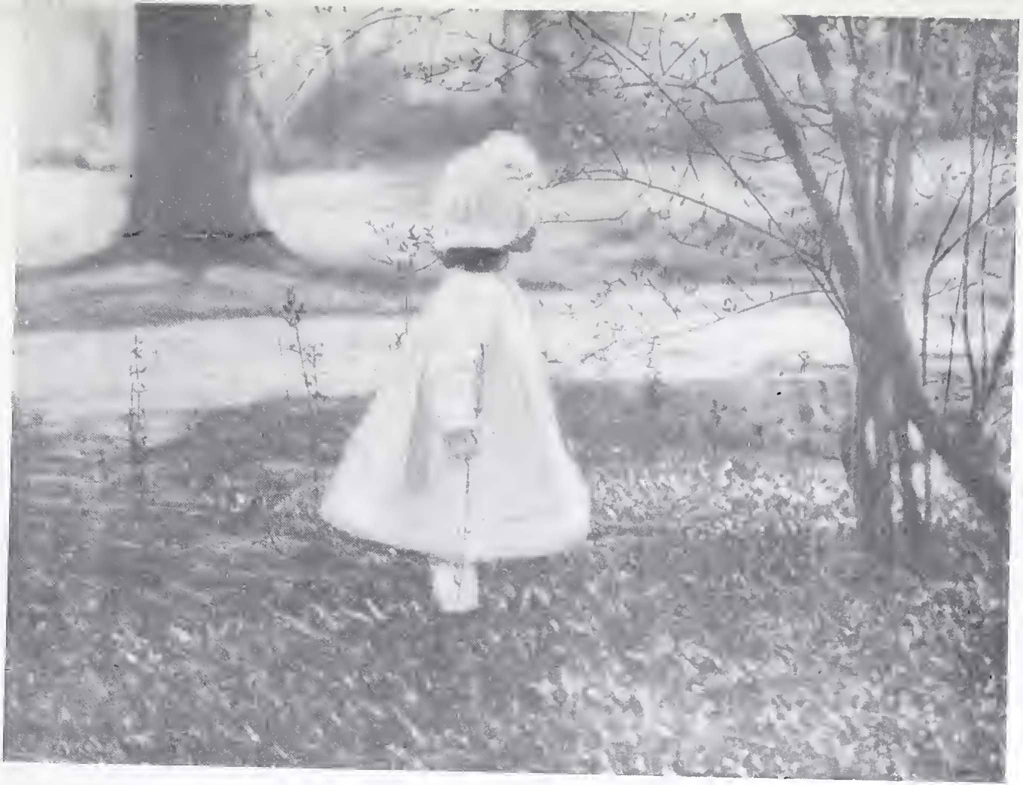
We have learned that the quality of a lens depends upon its ability to converge to precise points the image-bearing rays reflected from the innumerable luminous points which make up the surfaces of objects. Of the image-bearing rays collected by the lens, some are known as direct rays, i. e., enter the lens in a direction parallel with its axis (an imaginary straight line through the center of the lens, connecting all the centers from which the curves of its elements were drawn), while others are known as oblique rays, i. e., enter and pass through the lens at an angle to its axis. Similarly, rays which pass through the lens at or near its axis are called central or axial rays, while those passing through the lens at or near its edges or margins are called marginal rays.

Definition

All these conditions affect the action of the lens and complicate the task of its correction so that it will give a true image of any object. Thus, in order to produce a sharply defined image of an object, the lens must converge all the rays reaching it from any single luminous point in the object (whether direct or oblique rays and whether passing through the center or the margins of the lens) to a corresponding image point—a small point not exceeding $\frac{1}{100}$ of an inch in diameter, without indistinctness or diffusion. Where extremely fine definition is required, as in process reproduction or the making of small negatives for enlargement, the image point must not exceed $\frac{1}{200}$ of an inch in diameter. It is a comparatively simple matter to correct a lens so that it will give a sharply defined image within a small area (as in the center of the field, i. e., that portion of the picture formed by the direct axial rays); but when we require critical definition throughout the whole field, as in copying or reproduction work; or great rapidity, as in photographing rapidly moving objects, we must utilize as much as possible of the total volume of light reaching the first surface of the lens (which means using direct and oblique central rays passing through every portion of the lens); and this, because of the aberrations of the lens, presents problems of great difficulty to the lensmaker. In keeping with this we have good rectilinear lenses, corrected for a comparatively small image area at the center of the field and listed for use with a 3¼ x 4¼ plate at *f*/8, selling at fifteen dollars, while the Zeiss Tessar Series Ic, fully corrected for uniform precision and sharpness of definition from the center to the extreme edges of the same size plate and doing this at *f*/4.5, is listed at forty-seven dollars. Note that apart from its superior defining power over a larger area, the Tessar is four times as rapid as the rectilinear, which means that the exposures would be as 1 to 4. With this knowledge of the lens, its make up and the work it has to do, let us now turn to its aberrations and see how they interfere with the two-fold capacity desired—defining power and rapidity.

Spherical Aberration

Spherical aberration, so called because it proceeds from the form or shape of the lens, is positive or negative in character according to the shape of the lens. In a photographic (convergent) lens, it is defined as the inability



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"My busy day"
Jean M. Hutchinson

of the lens to bring to a precise point both the central and marginal rays of the same pencil of light. Properly speaking, the term refers only to direct rays—those which form the central portion of the picture-image. When oblique rays are considered, the error is known as zonal aberration, or coma. In all its forms it results in indistinct, diffused image points—really discs instead of precise points. Sharp definition is impossible with a lens in which this error has not been corrected at least in some measure. This is usually effected by combining positive and negative lenses of such refractive powers that the error of the negative lens counterbalances the opposite error of the positive. The amount of spherical error remaining in a lens which has been partially corrected in this way can be further reduced by placing in front of the lens a "stop" or diaphragm with an aperture smaller than the full diameter of the lens itself, thus cutting off the marginal rays which cause the trouble and permitting only the central or direct axial rays to pass to the image field. This, of course, means that we are using only part of the light reaching the first surface of the lens in the formation of the image, with a consequent loss of rapidity. Thus the single lenses supplied in the cheaper sorts of hand-cameras are only roughly corrected for spherical and other errors, their defining capacity depending on the use of diaphragms with small apertures.

Chromatic Aberration

Chromatic aberration is the inability of the lens to converge a ray of white light reflected from a luminous point to a corresponding point of white light in the image, due to the dispersion or separation by the lens of the several color-rays making up the white ray. This dispersion of the color-rays causes them, when converged, to meet at different distances from the lens instead of in a precise point. The error is corrected by combining positive and negative lenses of different dispersive powers, so that the negative aberration of the one destroys the positive aberration of the other. All photographic lenses are corrected so that the yellow (visual) and blue-violet (chemical) rays will meet in a precise point. Lenses thus corrected for two colors are described as achromatic; when corrected for three or more colors, as is necessary in three-color and reproduction work, they are described as apochromatic. A lens which is corrected for spherical and chromatic aberration is said to be *aplanatic*.

Curvature of Field

Hitherto we have assumed that the lens brings its image to a focus in a plane, such as the ground-glass focusing screen or sensitive plate. As a matter of fact, however, the focal surface is a curved field instead of a plane, so that to obtain a sharply defined image of a flat object, such as a series of circles drawn upon a wall or any other flat design, the sensitive plate should be concave or saucer-shaped in form. This inability of the lens to give a sharply defined image on a flat field is due to the aberration of form known as curvature of field. All lenses except anastigmats have this error. Its correction is important in lenses used in copying or in photographing objects in low relief, or groups where the figures are arranged in straight lines. It can be reduced by the use of a diaphragm with a small aperture or by combining a slightly concave (divergent) lens with the positive. The best anastigmats are quite free from this error, and so are described as possessing "a perfectly flat field," for which reason these lenses are preferred for copying and all reproduction work.

Distortion

The aberration known as curvilinear or marginal distortion is due to the varying thicknesses of the lens, and expresses its inability to reproduce straight lines in the object as straight lines in the image. It exists in all single lenses with two or three exceptions, the kind of distortion varying according to the position of the stop or diaphragm. When the diaphragm is fixed in front of the lens the distortion is "barrel-shaped," so that marginal lines are represented as curved outward at the middle. With the diaphragm behind the lens the distortion is of the "pin-cushion" shape, marginal lines appearing as curved in the middle. This defect renders the single lens useless for architectural or other work where straight lines play a prominent part. It is corrected by combining two lenses with similar but opposite errors and placing the stop or diaphragm midway between them, so that the distortion produced by the one is corrected by the opposite distortion of the other. Lenses so corrected to reproduce straight lines as straight lines are known as "rectilinear" or "doublet" or orthoscopic lenses.

Astigmatism

Astigmatism is the most widely advertised and least clearly understood of lens aberrations. It expresses the inability of the lens to give at or near the margins of the field an image of an object containing vertical and horizontal lines in which both lines are sharply defined at the same time. It refers only to the bundles of rays which pass through the lens obliquely to its axis and affects the marginal definition of the picture-image. Thus, where this error exists in a lens, the image-bearing rays reaching the lens obliquely are converged to two blurred lines at right angles to each other instead of a precise point. For example: If we set up a card inscribed with a boldly printed plus sign and attempt to focus the sign with a lens in which this error has not been corrected, we may get both vertical and horizontal lines sharply defined at the same time in the center of the screen, but as we move the camera so that the image travels from the center to the edges of the screen, one or other of the lines will assume a blurred ellipsoidal form. Hence the practical result of astigmatism in a lens is a lack of sharp definition in the marginal portions of the photograph, which destroys the usefulness of the lens for architectural photography, copying or other branches of work where critical definition over the whole field combined with rapidity are essential to success. The correction of astigmatism is effected by ingenious combinations of various kinds of glass possessing different powers of refraction and dispersion, and arrangements of curves and thicknesses made possible by the many varieties of optical glass placed at the service of lens-makers by the researches of Abbe and Schott, at Jena, during the early eighties. Lenses in which this error is corrected, and which are therefore capable of reproducing marginal points in an object as points in the image, are called anastigmats, orthostigmats, verastigmats, plastigmats, or simply stigmats, the basic word *stigma* meaning "a point," *astigmatic* meaning "without a point," and *anastigmat* meaning "back again to a point." Apart from this real significance, however, an anastigmat is generally understood to mean a lens in which all the five or six principal errors or aberrations are largely or wholly corrected, so that it will give a sharply defined image with a flat field within a comparatively large angle when used at a large aperture. Thus the correction of astigmatism is seen to be a great advance in the attempt to combine defining power and rapidity in the lens.

Lenses Classified

Turning now to the trade catalogues, we find lenses described under many different names, and the prices seem to differ as variously as the names. Let us classify them according to their capacities.

Single Lenses

I: Single lenses, otherwise called single achromatic, meniscus, achromatic meniscus lenses, are nowadays usually sold as irremovable parts of the inexpensive hand-cameras to which they are fitted. They are also sold separately, for use in combination with other lenses, as "supplementary" lenses under various trade names. They are made up of two simple positive and negative lenses cemented together, chromatic and spherical aberration being thus at least partially corrected. With this correction and the further help of the small diaphragm apertures with which they are fitted, these single lenses are capable of very good work within a limited scope. The necessary use of small apertures, rarely larger than $f/16$—one-sixteenth of the focal length of the lens—makes them slow, so that successful work with them depends upon favorable conditions, such as fairly distant subjects, sunlight days out-of-doors, or subjects without movement such as landscapes, where critical definition over the whole field is not necessary, etc. Similarly, since single lenses are not corrected for distortion, they cannot be used in photographing buildings, copying, or subjects with prominent lines near the margins of the field, as such lines will be represented as curved in the picture. Apart from these disadvantages, the single lens properly understood and used with discretion has its peculiar good points for certain kinds of work, such as pictorial landscape, wherein its "depth" (due to its small aperture) and softly diffused definition (due to the amount of spherical aberration left uncorrected) are especially desirable. The really excellent work produced with the cheap hand-cameras fitted with these single lenses offers further proof of their usefulness. For purely pictorial work the single lens will give results wholly pleasing.

Single Anastigmats

Mention should be made here of the fact that the introduction of new kinds of Jena glass has made possible the construction of single lenses practically rectilinear and anastigmatically corrected to give sharply defined images over a flat field with the comparatively large aperture of *f*/12. These remarkable lenses, of which the Zeiss Series VII and Gray's Double Stigmat are examples, have been evolved in the construction of the Convertible Anastigmats introduced by Zeiss under the name Double Protar VIIa and by Gray under the name of Double Stigmat. See further under "Anastigmats."

Supplementary Lenses

The single lenses sold as "supplementary" lenses are simply achromatic positive or negative elements of different focal lengths, which, when used with the lens already fitted to the camera, diminish or increase the focus of the original lens and so enable the user to get larger images of distant objects, or to photograph objects nearer to the camera than was possible before, or add to the covering power of the lens so that it will cover a larger plate as a "wide-angle" lens. These "supplementary" lenses come in "sets," each lens being marked with its proper use, so that no abstruse calculations are needed. In Europe the use of simple, non-achromatic spectacle lenses as "supplementary" lenses or "magnifiers" is more common than on this side of the Atlantic. They offer a wider range of possibilities than the "cut-and-dried" sets, but require individual calculation in their adaptation for practical use. Two very practical papers dealing with this adaptation of spectacle lenses in this way may be found in *Photography* for February 12 and March 5, 1907.

Rectilinears

II: Rectilinear lenses, formerly known as "doublets," but also variously described as rapid rectilinears, symmetricals, double symmetricals, aplanatic, convertible, rectigraphic or tri-focal lenses, according to their make-up, are usually composed of two single lenses mounted in a tube at some little distance apart with the diaphragm or stop midway between them. This construction permits the elimination of the error of distortion and the better correction of spherical aberration, also allowing the use of larger diaphragm apertures, so that the rectilinear represents an advance over the single lens in defining power and rapidity. Thus the average rectilinear is usually listed to cover the plate for which it is made at *f*/8, theoretically four times as rapid as the single lens at *f*/16, but practically eight times more rapid, since the latter would have to be "stopped down" to *f*/22 to define the image equally well over the same area. Until the advent of Jena glass and the anastigmat, the rectilinear represented the highest achievement among lenses for general uses, and it is still quite good enough for 80 per cent of the work of the photographer, provided that he does not want to attempt high-speed work, three-color or fine reproduction or scientific photography.

Symmetricals

When composed of two single lenses of approximately the same focal length, the rectilinear is known as symmetrical and combines two lenses,—the double objective (or lens used as a whole) and the rear element used alone as a single lens, in which case the single element will have twice the focal length of the doublet or whole lens. When a single element of an objective is used in this way, its rapidity is diminished by the necessity for the use of smaller diaphragm apertures—about which more will be said when we consider the use of the diaphgram.

Convertible: Tri-focal

Rectilinears made up of single lenses of different focal lengths are sometimes spoken of as unsymmetrical doublets. When these are so constructed that the single elements can be used separately, we have what is known as a convertible or three-focus or "tri-focal" lens. This simply means that the objective is made up of two corrected lenses of different focal lengths, either of which may be used as a separate lens, so that the objective embodies three lenses and a choice of three different focal lengths. The well-known Gundlach Rapid Rectigraphic is typical of this class. Thus No. 1 of the series, listed for a 4 x 5 plate, is made up of two elements of 10-inch and 13½ inch focal length respectively, the focal length of the combination being 6¼ inches. The signification of focal length will be explained later.

Lens Sets

This evolution of the tri-focal or convertible lens led to the introduction of "lens sets." These usually comprise a tube or exposure shutter with from three to seven achromatic elements which, by various combinations, according to directions accompanying the "set," provide from six to fifteen different lenses adapted for various purposes. In the cheaper "sets" the correction of the lenses is indifferent, so that the various combinations are slow and give soft rather than sharply defined images. The Anastigmat "sets," however, are more carefully corrected and give results which justify the higher prices asked for them.

Extra-Rapid Rectilinears

In the endeavor to improve the rectilinear before the new Jena glasses made the anastigmat possible, a specially rapid rectilinear was introduced under the names biplanat, euryscope, etc., with about twice the rapidity of the ordinary rectilinear, that is, working with apertures *f*/5.6 or *f*/6. This extra rapidity, however, was gained by sacrificing covering power, and since the introduction of the anastigmat these lenses have fallen from favor. To sum up, then, for all ordinary purposes where critical definition from the center to the edges of the plate and rapidity are not essential, the rectilinear of today, with a rapidity expressed by an aperture of *f*/8, is as good a lens as the amateur can desire. In every day work out-of-doors or indoors, its lack of complete correction will often prove advantageous, giving softer definition at the edges of the picture-image, a better separation of the planes of the picture field and greater "depth."

On the other hand, when subjects including rapid movement are in question, as in focal-plane photography, or where we may be required to get good negatives of difficult subjects on dull days under unfavorable conditions of illumination, for portraiture indoors, nature subjects, animal photography, three-color reproduction and scientific work of all kinds, we can best ensure success by using a lens which by its more perfect correction will give us every possible advantage in defining power and rapidity. This we have in the anastigmat, which, plainly put, is simply the highest type of the rectilinear at present available.

Anastigmats

III: Anastigmats differ in form and name so variously with each maker that it is difficult to group or classify them in any way which will help us in an intelligent estimate of their qualities. This is best accounted for by the fact that the many varieties of optical glass now available provide many different ways of attaining the same end. The result of this was seen as soon as the first anastigmats were introduced; other opticians quickly perceived that the new glasses offered other ways of attaining the same superior correction, and soon after there were as many different anastigmats as there were different makers. The same procedure followed the introduction of each new form of anastigmat by any maker, and this duplication has been further stimulated by competition, so that today the photographer is fairly bewildered by the variety of anastigmats from which he has to make choice for his purpose.

Points of Choice

Taking them, for the moment, as equal in general excellence (which they are not), the following three points are worthy of note in the choice of a particular lens from the many offered in the trade catalogues: (1) Covering power: In some anastigmats this decreases when the diaphragm is changed to a smaller aperture. This is not desirable. With many subjects it is desirable to be able to focus with a large aperture and then use a smaller aperture to get more "depth" or to regulate the exposure. (2) Initial rapidity: Other things being equal, it is better to choose a lens which will work at *f*/5.6 than at *f*/7 or *f*/8, simply because the first is twice as rapid as the last, requiring only half the exposure. (3) Some anastigmats can be used only in their complete form; others are convertible, i. e., their elements can be used separately, this affording two or three lenses of different focal lengths according to whether the complete lens is symmetrical or unsymmetrical in character. Other things being equal, and more especially if there is no sacrifice in the rapidity of the complete lens, the unsymmetrical convertible form offers the wildest possibilities of usefulness. Another point, already mentioned, should not be overlooked, viz., that of two lenses equal in rapidity and defining power, the one which defines the larger angle (greater width of image) is the better one. Apart from these general points, with anastigmats as with other lenses, the choice of a lens depends most largely upon the work for which it is required. From all that has been said, the reader will have grasped the fact that no one lens can do all things equally well and that every lens represents a compromise.

Universal Lenses

Lenses in the make-up of which special or particular abilities have been in some measure sacrificed to secure general all-round capacity are sometimes catalogued as "universal" lenses. The Goerz Dagor (Series III, *f*/6.8), the Collinear (Series III, *f*/6.8), the Cooke (Series III, *f*/6.5), the Homocentric (Series C, *f*/6.3) and the Plastigmat (*f*/6.8) belong to this class. All these offer a remarkable range of usefulness and leave little to be desired for all-round, every-day work with the hand- or stand-camera. Where price is not considered, however, the convertible anastigmat is undoubtedly the highest type of "universal" lens, since, by having three or four elements of different focal lengths, we can ourselves make up an objective to meet almost any possible requirement. The Zeiss Protar Series VIIa; the Turner Reich Anastigmat, Series II; the Verastigmat; and the Gray Double Stigmats are of this "convertible" class.

Special Lenses

Coming now to special lenses, we find in the catalogues mention made of wide-angle, portrait, telephotographic and process lenses. When properly listed under these names, these lenses are designed for special branches of work, and it may be assumed, as a general thing, that some other quality has been sacrificed where necessary, to give the lens special ability in its particular field. Process lenses do not come within the scope of this monograph and so will be passed over without detailed consideration in these pages.

The Wide-Angle Lens

IV: Much misconception prevails concerning "wide-angle" lenses. We will understand them better if we know something about angles. Since the lens is a disc, the field or area in which it projects the image is circular. The ability of a lens to evenly illuminate and define its image within this field constitutes its "covering power." Thus a lens is said to cover a "circle of illumination" and a "circle of definition." The greater the diameter of the circle within which the lens gives an evenly illuminated and equally well-defined image, the better the lens. The angle formed by two lines drawn from opposite ends of this diameter to the center of the diaphragm aperture of a doublet lens is known as the "angle of field" of the lens. Lenses are classed by lens-makers as narrow, medium or wide-angle lenses according to the measure of this angle. Users of lenses, however, are apt to classify lenses according to "angle of view," or the amount of subject included by the lens on the plate for which it is listed, i. e., within the base line or diagonal of the plate. This angle is measured by two lines drawn from opposite ends of the base line, or from two opposite corners of the plate to the center of the aperture of the diaphragm. Now, all lenses of the same focal length will include the same angle of view or the same amount of view on the same size plate—regardless of the name given them—provided that they are capable of covering the plate. In other words, the amount of view included by any lens of given focal length varies according to the base measurement of the plate used. In keeping with this, lenses which are designed to serve as wide-angle lenses are constructed to cover a large field, rapidity being sacrificed for this ability, and rarely work at a larger aperture than f/16. Gray's Series III Wide-Angle Stigmat is typical of this class. It is listed as having a "circle of illumination of 85 degrees, about 73 of which are shown diagonally on the largest plate listed for each, with no perceptible difference in sharpness of definition between the corners and the middle of the plate."

Extreme-Angle Lenses

Then we have "extreme-angle" lenses, the name of which explains itself. Gray's Extreme-Angle Periscope serves as an example of this class. It is listed to embrace an angle of 115 within the diagonal of the largest plate it will cover with an aperture of f/45. Applying the rule about focal length and base line governing the angle of view, we see that while the E. A. P. No. 3 will give 115 degrees on a plate 8 x 10, it will include only 80 degrees on a plate 5 x 7 and only 55 degrees on a 4 x 5 plate. From this it is plain that a lens built especially for wide-angle work has a larger field—a larger diameter of field in comparison with its focal length than the ordinary medium-angle (and usually more rapid) lens—and so is capable of including a wider angle of view on a larger plate, but that this greater capacity is based on covering power gained by sacrificing rapidity, the angle of view included depending on the relation between the focal length of the lens and the base measurement of the plate used.

Wide-Angle Anastigmats

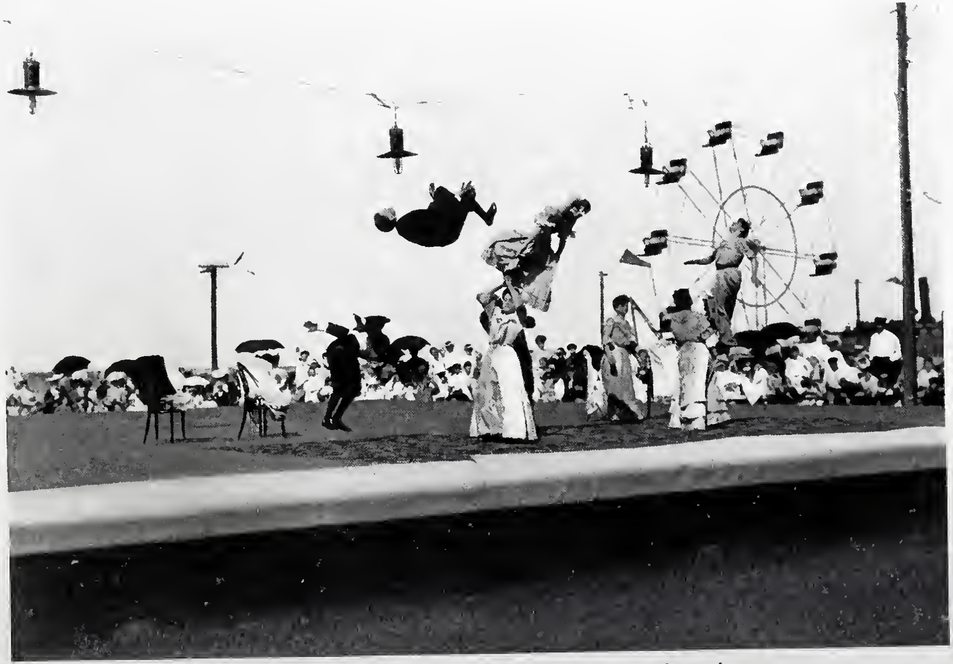
On the other hand, we have the anastigmat, with its remarkable covering power combined with greater rapidity than is possessed by the wide-angle lens, which makes the anastigmat an ideal wide-angle lens for general use. Thus the Goerz Dagor, Series III, by its fine correction over its large circle of illumination, will give a sharply defined image within an angle of 90 degrees with an aperture of *f*/16; provided, of course, that we use a plate large enough to receive this angle of view at the equivalent focal length of the lens. The Cooke, Series III; the Collinear, Series II; the Zeiss, Series IV; the Gray Stigmat, Series II, the Homocentric, Series D, and the Turner-Reich anastigmat, Series II, are all good lenses of this class. Among extreme-angle lenses of the anastigmatic class, mention should be made of the Goerz Hypergon, with a capacity of 135 degrees; the B. & L. Zeiss, Series V, with a capacity of 110 degrees;

and the Beck-Steinheil Orthostigmat, with a capacity of over 90 degrees.

Portrait Lenses

Lenses especially designed for portraiture belong to a special class. In the construction of such lenses, everything is sacrificed to secure great rapidity with sharp definition within a very limited field. Thus we have portrait lenses listed as working at apertures of *f*/2.2, *f*/4, *f*/5, *f*/6; a lens working at *f*/2 being four times as fast as one working at *f*/4, six times as fast as an *f*/5, and nine times as fast as an *f*/6. Such lenses necessarily have very little depth of definition when used at full aperture and, when smaller diaphragm apertures are used to give greater depth, the loss of rapidity is generally accompanied by other disadvantages. The field of a portrait lens is extremely curved, and its defining power fails rapidly from the center of the field. For these and other reasons, such as its limited usefulness and great cost, the special portrait lens is rapidly being displaced by the anastigmat, which will do equally well all that the specially designed portrait lens can do and has a much wider field of usefulness, because of its better correction. Of anastigmat portrait lenses the Zeiss Portrait Unar, Series Ib, is a notable example, combining the good qualities of the anastigmat with the ability to secure softness, roundness and gradation, these latter being controlled by an adjustment fitted to the front lens by which its elements may be separated or brought closer together at will, this adjustment permitting any amount of diffusion of definition desired. The Heliar, the Goerz Celor, the Cooke Series II, and the Homocentric Series B also belong to this class. Among old-style portrait lenses, those of Dallmeyer, Ross, Bausch & Lomb and Voigtlander still retain their preëminence, although of late years the market has been flooded with less expensive lenses designed for portrait and group work. In purchasing a lens from this last class as a matter of economy, the buyer should satisfy himself by practical test that the lens has the qualities required for the work it is to do. A special Achromatic-Meniscus Portrait Lens for amateurs, giving softly diffused images at *f*/6, is offered by the Gundlach-Manhattan Company.

Crater of the Dragon's Mouth Geyser, Wairakei, New Zealand
Walter Burke



An exposure of 1-1400th second with a between-lens shutter

Made by Gustav Dietz with his Multi-speed Shutter, Goerz lens, Series III, No. 5, 10¾-inch focus, 1-1400th second. Summer day, clear, 4 p. m. Note the definition in principal figures and the depth of field, with complete absence of blur or motion

Anastigmats for Amateurs As far as amateur portraiture is concerned, whether in a home studio, or the rooms of the house or out-of-doors, there can be no question but that the anastigmat is the lens best adapted to the purpose, apart from its usefulness for other branches of work. This is especially true of the B. & L. Zeiss Unar with its diffusing adjustment, which will give softness or pictorial definition when this is desired or the critical definition peculiar to the anastigmat when used for other purposes than portraiture. Similarly the Goerz Celor, because of its symmetrical construction, offers the advantages of a portrait lens working at *f*/4.5 and a single lens (the back element) of double the focal length of the whole objective, yielding the same definition as the whole lens at *f*/32 and having twice its covering power.

Telephoto Lenses V: The telephotographic lens is an objective or lens system of somewhat complex construction, designed to give larger images of distant objects than can be obtained with an ordinary photographic lens. The peculiar properties which make it preëminent in this special branch of work also make it useful in animal photography, portraiture, and other special applications of photography. As a detailed explanation of the lens and its uses would fill a volume of goodly size, the reader desiring a comprehensive account of these is referred to such works as Lummer's *Photographic Optics*, Beck's *Photographic Lenses* and Marriage's *Elementary Telephotography*, wherein the subject is dealt with at length. The following summary will probably suffice for many of my readers.

Size of Image The size of the image of an object depends upon: (1) the distance of the object from the lens, and (2) the focal lengths of the lens used in making the photograph (which, roughly speaking, is the distance between the diaphragm of the lens and the focusing screen when a distant is sharply focused on the screen). We can therefore vary the size of the image, or scale of our reproduction of an object, either by photographing it from different distances, or by the use of lenses of different focal lengths. Where it is impossible, difficult or undesirable to alter the distance from which the object is to be photographed, then we can vary the size of the image only by using lenses of different focal lengths. The rule here is that of an object at a given distance, the longer the focal lengths of the lens, the larger is the image obtained. And, of course, whatever the focal length of the lens, the bellows-extension capacity of the camera must be sufficient to allow of the separation of lens and plate necessary to give a properly focused image. So that the getting of large images of distant objects ordinarily involves the use of large, unwieldy lenses of great focal length and cameras with unusual bellows capacity.

Tele Combinations

The telephotographic lens system, made up of a combination in one tube of an ordinary photographic lens with a special negative (magnifying) lens, gives all the advantages of a long-focus lens without the need of a corresponding increase of bellows extension. Thus the telephotographic lens is lighter, less bulky and less costly than an ordinary lens of the same focal length, and will give larger images of distant objects with small cameras with short bellows extension than can be obtained by any other method. Telephoto lenses are sold as complete instruments (an ordinary or positive objective combined with a negative element, mounted in a tube fitted with rack and pinion movement or in an adjustable tube permitting the required separation of the lenses); or simply in the form of telephoto attachments (an achromatic negative lens mounted in a tube with rack and pinion, the tube being threaded to receive an ordinary photographic lens). The latter form is generally preferred, as the attachment can be removed at will, leaving the positive lens unaltered for every-day work. The separation of the positive and negative elements by means of the rack and pinion movement varies the focal length of the system, so that the telephoto lens is really a long-focus lens of variable focal length. The degree of the magnification or enlargement of the image depends upon the separation of the two elements, the magnification being greater as the two elements are brought closer together. By various combinations of negative and positive elements of different focal lengths and suitable bellows extension, a telephoto system is obtained, giving a definite range of magnifications according to the requirements of the individual worker. Tele-negative lenses or telephoto (complete) objectives are supplied by almost all the principal lens makers, the Bausch & Lomb Company and the Gundlach-Manhattan Optical Company offering inexpensive tele attachments specially designed for hand-camera work.

In the choice of a lens for practical use the three points of chief interest are: the focal length of the lens, its rapidity and its covering power. Let us consider them very briefly in their order.

The Significance of Focal Length

The focal length of a lens is important because: (1) It determines the scale of the picture or the size of the image of the object photographed. Thus, if in photographing a house at any given distance with a lens of four inches focal length we get an image of the house one inch in height, then a lens of eight inches focal length will give us an image of the house two inches in height, photographing from the same distance. As lenses may be made with any focal length desired, a choice is usually made within a narrow range of differences based on the size of the plate with which the lens is to be used. For ordinary purposes the lens should have a focal length about one-third greater than the longest side of the plate, this giving an image of desirable size in relation to the size of the resulting photograph. Apart from this very general provision, the different requirements of various applications of photography make different focal lengths desirable. (2) The focal length of the lens in relation to the size of the plate used determines the angle of view or amount of the subject included in the picture. All lenses of the same focal length embrace the same angle of view (or include the same amount of subject) when used with the same size of plate; but the same lens will include different angles of view if used on plates of different sizes; and two lenses of different focal lengths will include different angles of view if used on the same size of plate. Thus a lens of six inches focal length will include an angle of view of about 60° on the longest way of a plate 5 x 7; but the same lens, if used on a plate 3¼ x 4¼, will include an angle of view of about 40° only. Similarly, every lens of six inches focal length, no matter what name or classification it may have in the trade catalogue, will include the same angle of view on a plate of given size. (3) The focal length of the lens also tells us what extension capacity is necessary in the camera with which it is to be used. Thus we cannot use a lens of eight inches focal length on a camera which will extend only six inches, an eight-inch lens requiring a camera extension of at least eight inches to permit the focusing of very distant objects, while the ability to focus near objects will call for three or four inches extra extension and the ability to copy or photograph objects full size calls for camera extension at least twice the measure of the focal length of the lens used.

Focus and Focal Length

"Focal length" and "focus" are two lens terms with separate and distinct meanings, although commonly used to express one and the same thing. The focus of a lens is the point behind the lens in which parallel rays, i. e., rays coming from a very distant object, meet after passing through the lens. Opticians call this point the "principal focus" of the lens. The focal length of a lens is the distance between the principal focus and another point in or before or behind the lens when a distant object is sharply focused. The position of this second point, formerly spoken of as the "optical center" but more properly known as the "focal center" of the lens, varies in different kinds of lenses, so that the precise determination of the focal length of a lens is not easily explained. For all practical purposes, the focal length of a single lens, such as is fitted to most hand-cameras sold at less than ten dollars, is the distance between the lens and the plate when a distant object is sharply focused. With rectilinear and symmetrical doublets, the focal length is the distance between the plate and the diaphragm in the lens under the same conditions. In unsymmetrical objectives the focal center or point from which the focal length is measured may be outside the objective, as in the case of the telephoto lens. Precise methods of finding the focal length of lenses of all kinds may be found in the text-books. The focal length of a lens is sometimes spoken of as its "equivalent focus" or, more simply, as its "focus," the three terms signifying the same thing in every-day use. Old lenses, and especially portrait lenses, are often described as having such and such a "back focus" or back focal length. This simply expresses the distance between the plate and the back surface of the lens in ordinary use, thus indicating the minimum amount of camera extension required, but rarely coinciding with the actual focal length of the lens.

Conjugate Foci

Since the rays reaching the lens from a very distant object are parallel rays, the image of a distant object is sharply focused at the principal focus of the lens. Images of objects at varying distances from the camera, however, necessarily come to a focus at different distances from the lens. Thus, for every distance between lens and object there is a corresponding distance between the lens and the image. These distances are known as conjugate foci, i. e., foci which are yoked together or depend upon each other. A knowledge of conjugate foci is necessary in enlarging or reducing pictures to a given size, and in the calculation of focusing scales for hand-cameras. The subject is very fully dealt with in Piper's *First Book of the Lens*, and, with regard to the hand-camera, in Coventry's *Technics of the Hand-Camera*.

Hyper-focal Distance and "Fixed Focus"

With every lens there is a distance beyond which all objects will be fairly well defined in the photograph when the lens is focused for infinity (or a very distant object). This distance—the nearest distance beyond which everything will be fairly sharp in the picture—is known as the hyper-focal distance, and varies with the focal length of the lens and the diaphragm aperture used. Thus, with a lens of five inches focal length, working at *f*/8, everything more than twenty-six feet away from the camera will be sharply focused. If we use the diaphragm marked *f*/16, then everything beyond thirteen feet away will be in focus, and so on. When lens and stop are adjusted to give all objects beyond a certain distance in focus, the lens is commonly spoken of as working at a "fixed focus." In some cameras the lens is irremovably fixed in this way in the front of the camera (as in the No. 1A F. P. Kodak) and the lens is described as "with fixed focus." A table showing the minimum distances at and beyond which all objects are in focus with lenses of different focal lengths and different stops is given on page 152 of THE PHOTO-MINIATURE, No. 76.

Rapidity

The rapidity or speed of a lens refers to the intensity of the volume of light it transmits to the image plane, and is measured by the relation of its aperture to the focal length of the lens. The larger the diameter of the aperture in proportion to the focal length of the lens, the greater is the amount of light transmitted to form the image and, consequently, the more rapid is the lens. All lenses are provided with a contrivance by which the amount of light transmitted through the lens may be regulated at will within certain limits. This contrivance is a series of diaphragms or "stops," as they are commonly called, each diaphragm having an aperture with a definite relation to the focal length of the lens and to all the other diaphragms in the series. Sometimes these diaphragms are separate pieces of thin metal consecutively numbered, which are known as Waterhouse stops; at other times the apertures are provided in a metal disk which rotates in front of the lens, known as "rotating stops"; but generally the diaphragm apertures are formed by a set of thin plates which open and close like the iris of the eye, this form being known as an "iris diaphragm." The form of the diaphragm does not in any way affect its action on the lens.

Diaphragm System

Whatever the form of the diaphragm system fitted to the lens, each different aperture it provides is numbered with a figure which expresses the relationship between the diameter or area of the aperture and the focal length of the lens. This numbering is done in several different ways, the two methods most generally employed being known as the "F-value system" and the "Uniform System." The latter, introduced by the Royal Photographic Society some years ago and later abandoned by the society, is still used with all the lenses fitted to kodaks and so is by no means obsolete. The "F-value system," however, is the only rational method of marking the practical value of diaphragms and is here considered first.

F-Value System

In the "F-value" method the different stops are marked with fractional numbers directly indicating the ratio of the diaphragm aperture to the focal length of the lens. The series begins with the largest aperture, and is so arranged that each succeeding (smaller) aperture requires double the exposure required with the preceding (larger) aperture or half the exposure required with the next following (smaller) aperture. Thus, supposing the largest aperture in the series has a diameter equal to one-quarter of the focal length of the lens, it is marked *f*/4; the next smaller aperture, requiring double the exposure required with *f*/4, is marked *f*/5.6; the next smaller is marked *f*/8; the next, *f*/11.3; the next, *f*/16; the next, *f*/22.6; the next, *f*/32; the next, *f*/45 and the next and last, *f*/64. With lenses whose diaphragms are not numbered in this way, such as lenses with apertures marked *f*/6.5, *f*/6.8, *f*/7.7, *f*/12.5, the rule of doubling the exposure for each succeeding (smaller) aperture does not apply.

U. S. System

In the U. S. or "Uniform System" the diaphragms are arranged in the same order as that given above, but, beginning with the largest aperture known when the system was introduced, viz., *f*/4, this is marked No. 1, the others following in an order which indicates the increase in exposure required with each aperture as compared with that required with the aperture immediately preceding. Thus, *f*/5.6 is U. S. No. 2, requiring twice the exposure required by U. S. No. 1; *f*/8 is U. S. No. 4, requiring four times the exposure required by U. S. No. 1, and twice the exposure required by U. S. No. 2; *f*/11.3 is U. S. No. 8; *f*/16 is U. S. No. 16; *f*/22 is U. S. No. 32; *f*/32 is U. S. No. 64; *f*/45 is U. S. No.

128; and *f*/64 is U. S. No. 275. By this system the relative exposures required by the different apertures are shown at a glance. If we know, for example, that the exposure with U. S. No. 1 is one second, then we know that the exposure with U. S. No. 4 will be four seconds; with U. S. No. 8, 8 seconds; with U. S. No. 256 it will be 256 seconds, and so on.

How Speed is Expressed

The rapidity or speed of a lens is always expressed in the trade catalogue by the number of the largest aperture at at which it will cover the plate for which it is listed. Lenses with apertures less than *f*/11 are slow lenses; those with apertures from *f*/6 to *f*/8 are rapid lenses; while those with apertures larger than *f*/6 are extra-rapid.

Covering Power

Since the diaphragm aperture through which the light reaches the plate is circular, so the field or area in which the lens projects its image is a circle. The ability of the lens to evenly illuminate and define its image within this circle constitutes its covering power. The greater the diameter of the circle within which the lens gives an evenly illuminated and evenly well-defined image, the greater is its covering power said to be and the better the lens. In many lenses the circle of illumination is larger than the circle of definition, but in all the better sorts of lenses the lens will define right up to the edges of its circle of illumination. The largest plate a lens will cover is the largest plate which can be placed within its circle of illumination. This means that there will be no falling away of the light at the corners of the picture. Whether the edges of the picture-image are as sharply defined as the central portion depends upon the correction of the lens for defining power. Provided that the lens is capable of illuminating the whole of the plate, we can improve the marginal definition of the picture by using small stops, but this reduces the rapidity of the lens and lengthens the exposures required. It is the capacity of the anastigmat to give an evenly illuminated and sharply defined image over a large field at a large aperture which makes it superior to all the earlier forms of lenses which depended largely on the use of small apertures for their definition.

Comparison of Values Thus the Tessar, Series Ic, which will cover perfectly (i.e., give a perfectly defined and evenly illuminated image) a plate 5 x 7 at its full aperture of *f*/4.5, should be worth more than a good rectilinear which has to be stopped down to *f*/16 to cover a plate of the same size equally well, since it is sixteen times more rapid than the rectilinear and makes successful negatives possible under conditions facing which the rectilinear at *f* 16 would mean failure. Apart from this greater rapidity, the definition given by the Tessar at *f*/4.5 will be better than that given by the rectilinear at *f*/16. What is here said of the Tessar applies, of course, to any good anastigmat listed to cover the same plate at the same aperture.

Excess Covering Power In all the better sorts of lenses the covering power of the lens exceeds the dimensions of the plate which the lens is listed to cover. This is necessary because when we raise or lower the camera-front carrying the lens, as many subjects require, the circle of illumination is raised or lowered at the same time and if the covering power of the lens just reached the corners of the plate when centrally placed (its normal position), then the upper or lower corners of the plate would not be covered and we should have dark corners in the picture. In keeping with this, the larger the diameter of the field covered by a lens as compared with the largest dimension of the plate it is listed to cover (provided this capacity is not gained at the expense of rapidity), so much the more useful will the lens be. Correlative with this, however, in the selection of a lens where great covering power is desirable, preference should be given to one having relatively large glasses, because such a lens will give a more equally illuminated field than can be had with another the diameter of which is little or no larger than its largest aperture. The difference between lenses in this respect may be seen by looking through the lenses under comparison. If the diameter of the glasses is about the same as the diameter of the diaphragm, the aperture will appear elliptical from every point of view except through the axis of the lens, and the intensity of illumination will diminish rapidly from the middle to the margins of the image. If, on the other hand, the lens glasses are considerably larger than the largest diaphragm aperture, then the elliptical or "vignetted" effect will not appear except at the extreme edges of the image field, and we can be sure that the whole of the plate will be uniformly illuminated. This is especially desirable when the lens is to be used as a "wide-angle," whether specially designed for this purpose or not.

"Depth of Focus"

Probably no other lens term puzzles the amateur so much, or is so persistently overworked, misused and misunderstood as the term "depth of focus," otherwise spoken of as depth of definition, depth of field (the preferable term), or focal depth. As generally used, these terms are meant to express the property possessed by a lens of giving an equally sharp image of objects situated at different distances from the camera. Since, however, objects at different distances from the lens are necessarily brought to focal points at different distances behind the lens, it is obvious that, theoretically, at least, the lens has no such property as depth of focus. In other words, as a bluntly-spoken but honest lens-maker puts it in his last catalogue, "it would be about as easy to put the point of a pin in two places at one time as it would be to get the foci (or focal points) of two objects at unequal distances to come to a point in one and the same plane behind the lens."

Nevertheless, since in every-day work we do not insist on critical focusing or microscopic definition, agreeing that a photograph is sufficiently sharp if the image is made up of points not exceeding $\frac{1}{100}$ of an inch in diameter; and since in practice it is possible to so adjust the lens that it will bring the image points of objects at different distances so close together in the image plane that they seem to be reasonably sharply defined, so we say that there is a quality which may be termed depth of field—the range of distance or depth in the subject within which all objects will be rendered agreeably sharp in the photograph. As the average man is prone to want everything in his photographs "sharp" from near to distant objects, this quality of depth of field is well worth discussion.

On What it Depends

First, let us grasp the hard fact that depth of field is not a quality which exists in one lens and not in another because of some difference in their make-up or construction, but depends simply on the relation between the focal length and the aperture of the lens. All lenses of the same focal length, used with a given stop or diaphragm aperture, have the same depth of field. If we focus on an object twenty feet distant with any lens of five inches focal length with the aperture *f*/8, all objects distant from eleven to eighty-seven feet will be fairly sharp in the photograph. This applies to all lenses as here described, no matter what they may be called in the trade catalogue. Of two lenses of the same rapidity but differing in focal length, the lens of shorter focal length will have the greater depth of definition. Why? First: Because the aperture of the "short" lens is smaller in diameter, therefore the amount of fuzziness in the definition of objects not absolutely in focus is correspondingly less than it would be rendered by the aperture of larger diameter in the lens of longer focal length. Second: The depth of definition appears greater with the "short" lens because, the image being smaller, the eye and the granularity of the plate will not notice the fuzziness of parts slightly out of focus, which would be plainly apparent if magnified to the size in which they would be rendered by the lens of longer focal length. Of two lenses of the same focal length but differing in rapidity, the more rapid lens will apparently have less depth of field; but when "stopped down" to the same rapidity as the less rapid lens, the two lenses will have the same depth of field. Rapidity and depth of field cannot exist together in a lens at the same time. Thus no rapid lens, such as an anastigmat working at *f*/4.5, can render equally sharp both near and distant objects at the same time if used at its full aperture, but depth can be secured by stopping the lens down (i. e., by using the smaller stops or apertures). The smaller the aperture is, so much the more apparent depth of field will we secure, but this depth will always mean the sacrifice of rapidity and need longer exposures.

Further than this, the presence of a certain amount of spherical aberration in a lens increases its apparent depth of field. In this fact, together with their lesser rapidity, we have an explanation why the earlier rectilinears and many cheap lenses of today seem to have greater depth of field than the costly anastigmat.

Cemented vs. Uncemented Lenses

The introduction, during recent years, of anastigmats in which the different lens glasses are uncemented and in the construction of which air-spaces or "air-lenses" are utilized for the correction or adjustment of the objective, has brought forward questions as to the relative value of cemented and uncemented lenses, the merits and demerits of air-spaces in lenses, etc. These questions are not easily answered. Some time ago the whole matter was discussed by the principal European makers of lenses, with the general conclusion that each lens system should be considered by itself, both methods of construction (cemented and uncemented) having their advantages and disadvantages. Looking over the report of this discussion, I fail to find any real superiority demonstrated for one type as against the other, so that the reader can well afford to regard the claims of contending makers as chiefly of advertising value and make his choice on positive qualities demonstrated by the always reliable test of actual experience.

Choosing a Lens

With the information thus far given regarding the different types of lenses and the properties they possess, the reader should find little real difficulty in the selection of a lens to meet his individual requirements, or in the more intelligent use of such lenses as he may already possess. Of course, no one lens can be expected to do all kinds of things equally well. Different branches of photographic work call for different lens qualities, and, as we have seen, it is not possible to combine in one lens all the capacities needed for widely differing classes of subjects. A glance over these varying requirements in different branches of work may be useful.

Hand-Camera Lenses

For general hand-camera work the qualities chiefly required in the lens are defining power, covering power, depth of field and rapidity. Taking the last first, for all work where the exposures will range from $\frac{1}{5}$ to $\frac{1}{100}$ of a second, a lens working at *f*/11 will serve under favorable light conditions, but *f*/8 will give wider possibilities of success in dull weather or with different classes of subjects, being sufficiently rapid to allow of movement in the view if this is not too rapid and the object not too near the camera. For subjects including rapid movement, or requiring exposures ranging from $\frac{1}{100}$ to $\frac{1}{1000}$ of a second or higher, an anastigmat working at *f* 6 should be chosen, but for the fastest instantaneous work, with focal-plane shutters, where every possible advantage must be had, then a lens working at *f*/5.6 or *f* 4.5 is preferable. Since depth of field is very desirable in hand-camera work and yet cannot be combined with rapidity, we can compromise to advantage by the choice of a lens combining great covering power with short focal length, remembering that a short-focus lens gives greater depth than another of the same rapidity but longer focus. The short-focus lens will also give a wider view-angle, which is often desirable in hand-camera work. The focal lengths advised for hand-camera lenses are: for pictures 3¼ x 4¼, about 4½ inches; for 4 x 5, about 6 inches; for 5 x 7, 7½ inches. When pictorial photography, or figure or nature studies with the hand-camera are in question, however, these focal lengths will be too short to produce the most pleasing results, and lenses of greater focal length should be chosen. As mentioned on an earlier page, the best way to solve the hand-camera lens question is to know the extension capacity of the camera and then purchase that particular convertible two or three foci anastigmat which offers the largest possibilities in the way of different focal lengths and rapidities. If the limited extension of the camera does not permit this, then the special forms of anastigmats sold in cells ready for simple adjustment to the exposure shutter fitted to the camera offer a happy solution of the difficulty.

Outdoor Work

For outdoor photography of the average sort, which does not include rapidly moving objects or subjects requiring critical definition combined with rapidity, the rectilinear lens with a speed of *f*/8 has all the qualities needed for successful work. It shows its qualities best if stopped down to *f*/11 or *f*/16, and should not be used at its full aperture save under poor light conditions or when the subject includes movement. Correctly speaking, the rectilinear is inferior to the anastigmat only in its speed and marginal definition, the anastigmat being simply a more perfectly corrected rectilinear and not a separate or special type. Hence, where speed and marginal definition are not essential to success, the amateur can save money without sacrificing any desirable quality by buying a rectilinear and leaving the anastigmat for those who need the peculiar qualities in which it is supreme. The focal length of a rectilinear for general purposes should be about one-third longer than the longest way of the plate, but if much work is to be done in cities, where it is not always possible to get far enough from the subject, the focal length can be shorter, although it should always exceed the longest dimension of the plate used. For commercial work, where definition is generally imperative and rapidity a desirable factor, the anastigmat is preferable to the rectilinear for reasons already made plain. For outdoor sports of all kinds, groups and similar subjects, also, the anastigmat, with its greater speed and better covering power, gives advantages which it would be folly to despise. In copying and enlarging, too, the anastigmat leads because of its superior defining power.

Interiors: Buildings

For interior work and architectural photography we want angle of view, covering power and freedom from distortion, rapidity being of lesser importance. The angle of view included by a lens, as we know, is determined by the focal length of the lens in relation to the base line of the plate used. The shorter the focal length of the lens, the larger is the angle of view it will give on a plate of given size. Hence, we use wide-angle lenses most largely in this class of work, where it is often impossible to get far enough from the subject to permit the use of a lens of normal focal length. Since, however, the use of too short focus lenses gives violet perspectives, this should be avoided and a lens of normal focal length employed wherever possible. Covering power is essential because this class of work often calls for the use of the rising and falling front, the swing-back, etc. Unless the lens is capable of covering a much larger plate than that used with it, this will result in dark corners and imperfect illumination.

Home Portrait The selection of a lens for studio portraiture is too lengthy a subject to be ventured upon in this place, but for amateur portraiture at home the modern anastigmat will be found altogether satisfactory; in fact, there are many signs that the anastigmat will eventually replace the special portrait lens generally used by professional photographers.

BOOKS

The Lens: A Practical Guide to the Choice, Use and Testing of Photographic Objectives. By Bolas and Brown. 1902. 172 pp., illustrated. $1.25.

Photographic Lenses. By Beck and Andrews. 1905. 288 pp., illustrated. 75 cents.

Contributions to Photographic Optics. By O. Lummer. 1900. 135 pp. $2.

Photographic Optics. By R. S. Cole. 1899. 325 pp. (Theoretical.) $2.50.

A First Book of the Lens. By C. W. Piper. 1901. 165 pp. $1.25.

Optics of Photography. By J. Traill Taylor. Revised 1904. $1.75.

News and Comment

In exitu Israel de Egypto, etc. With the June issue of the *Photo-Beacon* Mr. F. Dundas Todd says *au revoir* to his readers and announces that the *Beacon* is to be merged with the "American Amateur Photographer" of this city. For some years Brother Todd has had a growing desire to abandon the dusty highways of photographic journalism and get back to running brooks, humming bees and the like. Now that fortune has favored him, he proposes to settle with his family in one of the Pacific coast states and spend the remainder of the century mixing mathematics and agriculture. Happy Todd! We who know him best will miss him most, but thousands who have benefited by his common sense will join us in the hope that the great West may smile on his adventure and give him the prosperity and happiness he deserves. The passing of the *Beacon* is a distinct loss to American photography, but we are glad to hear that Mr. Todd will occasionally contribute to the pages of the "A. A. P.," which, with Mr. Todd on the staff, now rejoices in no less than five editions! Until the mddle of August Mr. Todd may be addressed Box 82, Glencoe, Illinois.

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Another editorial retirement is that of Mr. Thomas Harrison Cummings from the *Photo-Era*, of Boston which paper is now owned and edited by Mr. Wilfred A. French, with Phil. M. Riley as associate. Mr. Cummings has reëntered the lecture field, in which he was a prominent figure in pre-*Photo-Era* days. Mr. Fraprie, who was associated with Mr. Cummings on the staff of the *Photo-Era*, is now one of the editors of the *American Amateur Photographer* of New York.

The announcement is also made that *The American Annual of Photography and Photographic Times Almanac* has been taken over by Tennant & Ward from its former owners and will hereafter be published by them under the editorship of John A. Tennant. Active preparations for the 1908 volume are now under way, and the book will be ready early in November as usual. It is desired, as far as possible, to improve the *Annual* in the quality of its reading matter and illustrations. To this end a cordial invitation is extended to the readers of THE PHOTO-MINIATURE to send in short papers dealing with practical work or good examples of pictorial photography. All correspondence relating to the *Annual*, contributions, etc., should hereafter be addressed to the Editor of The American Annual of Photography, 287 Fourth avenue, New York.

◆

An important question to be brought before the forthcoming National Photographic convention at Dayton, in August, concerns the giving of prizes at future meetings. Our professional readers are asked to consider the matter beforehand and go prepared to settle the problem.

◆

The new Cooke Lens catalogue (Taylor, Taylor & Hobson, Ltd., St. James Building, New York) is a handsome booklet of 24 pages, interestingly written and well illustrated. It tells of the special advantages of Cooke anastigmats, details the different series in plain language, and offers much useful information about lenses for fine photography. We note that this year the kodak can be purchased fitted with these well-known anastigmats. It would be difficult to find a more useful combination for serious work than a kodak fitted with a Cooke lens and a reliable shutter; and those in search of an ideal hand-camera outfit are here well provided for. See pages 44-45 of the New Kodak catalogue.

◆

The Kodak catalogue for 1908 is, as usual, a model of catalogue-making, well written and well printed. It has grown to 64 pages and gives full information about the different cameras grouped under the names Kodak, Brownie, Flexo, Bull's Eye, Panoram, Stereo Kodak, etc. Among the novelties for 1907 are a Brownie Developing Box for daylight development of No. 1 and No. 2 Brownie films; the No. 2 Brownie for pictures 2½ x 4¼ (a handy memo. camera); the 4 x 5 Folding Pocket kodak, and the Brownie Enlarging camera. Copies of the catalogue can be had from any kodak dealer.

❧

After reading the monograph on lenses which precedes these Notes, the reader cannot do better than send for the following catalogues, which will complete his information concerning lenses at present available: The Bausch & Lomb Optical Company, Rochester, N. Y.; the Gundlach-Manhattan Optical Company, Rochester, N. Y.; Geo. Murphy, Inc., 57 East Ninth street, New York, for Ross lenses; Gray-Lloyd Manufacturing Company, Ridgewood, N. J.; Taylor, Taylor & Hobson, Ltd., St. James Building, New York, for Cooke lenses; C. P. Goerz Optical Company, 52 Union Square, New York; International Fidelity Agency, 621 Broadway, New York, for Steinheil lenses and the Voigtländer & Son Optical Company, 133 West 23d Street, New York, for Collinear and Heliar lenses.

❧

Angelo Sepia Platinum paper is an old favorite, especially with the best class of professional portraitists. It should be better known and appreciated by amateurs, especially those who incline to home portraiture or large interior work. We note with pleasure that the manufacturers have brought out Angelo Black and White Platinum paper, in two grades, *rough* and *smooth*.

❧

All users of platinum papers will note with interest that Curtis & Cameron, Boston, publishers of the well-known Copley Prints, are offering for general sale two platinum papers of their own coating, viz.: Harcourt sepia and Harcourt gray. The first gives beautiful sepia prints with cold developer—a plain oxalate bath containing no mercury, not the usual "sepia" solution. Our trials of this paper gave us rich photogravure-like prints, with a long range of tone gradations. The Harcourt gray paper is peculiarly adapted to subjects having light grounds, white draperies, etc., giving delicate gradations in the half-tones of such subjects, while fully capable of producing pure blacks where needed.

❧

Perhaps the most remarkable catalogue of lenses yet published is that issued by the C. P. Goerz American Optical Company, New York. This is a sumptuous volume 8 x 12 inches, containing 64 pages of lens information, fully describing the Goerz lenses and optical instruments, and an additional 16-page supplement showing some twenty fine examples of lens work in various branches of photography. The frontispiece is a photogravure from one of A. Radclyffe Dugmore's bird-life studies, and the cover in black and gold reproduces Steichen's figure study which secured the first prize in the recent Goerz competition. The beauty and practical value of this catalogue can be best appreciated by seeing it, and every reader of the PHOTO-MINIATURE should secure a copy. In its make-up and usefulness it reflects great credit on the C. P. Goerz American Optical Company and its compiler, Mr. A. K. Boursault.

❧

An interesting set of lantern-slides, showing the possibilities of the Graflex camera and focal-plane shutter, has been prepared by the Folmer and Schwing Manufacturing Company, Rochester, N. Y. This collection is placed at the service of any American camera club for exhibition purposes free of charge. Application should be made direct to the Folmer and Schwing Manufacturing Company.

❧

An International Exhibition of Photographic Arts and Picture Postcard Show is announced to be held at Chicago, August 10 to 17. Medals and cash prizes will be awarded in all the sections. Applications for wall space or other particulars should be addressed to H. W. T. Tiernan, 3600 Michigan Boulevard, Chicago.

❧

An International Exhibition of Photography is announced to be held at Dresden in 1909. According to the report of the Inaugurating Committee, the exhibition is planned along comprehensive lines and will thoroughly cover all the branches and applications of photography,—scientific, pictorial and industrial. The coöperation of all photographic societies and individual workers in all countries is invited. Communications should be addressed to G. Springer, Dresden—A. 21, Germany.

❧

A practical booklet dealing with the advantages of tank development, with methods and formulæ, has been issued for free distribution by Burke & James, 118 W. Jackson Boulevard, Chicago. Copies can be had for the asking by mentioning THE PHOTO-MINIATURE and addressing Burke & James.

❧

Every advance in the speed of plates means added power to the photographer, but when accompanied by increased fineness of grain the advantage is still greater, because fineness of grain means better detail and gradation capacity in lights and shadows. The new plates of the Hammer Dry Plate Company, St. Louis, are much speedier than earlier products of this firm, and combine high speed with desirable fineness of grain. If there are any readers of THE PHOTO-MINIATURE still unacquainted with Hammer plates, we suggest an early trial of the Extra-Fast Special Red Label brand.

❧

The Premo catalogue for 1908, obtainable from all dealers, or the Rochester Optical Company, Rochester, New York, describes in detail all the specialties comprising the famous Premo line, showing many improvements in the new models. Especially worthy of mention is the Premograph, a 3¼ x 4¼ box-camera of the reflecting type, with full-size mirror and ground-glass, viewing-hood, etc. With this camera the operations necessary in making an exposure are reduced to three simple motions. The Premograph sells at ten dollars and should easily prove itself the most popular camera of the year.

❧

Remarkable interest has been excited by the announcement of the Multi-speed shutter, a new lens shutter introduced by the Multi-speed Shutter Company, 324 East 65th street, New York. This shutter is guaranteed to give accurate exposures from slow, instantaneous, bulb and time exposures to high instantaneous speeds, ranging from $\frac{1}{200}$ to $\frac{1}{2000}$ second, with three times as much illumination at the highest speeds as is obtained with a focal-plane shutter. It is even claimed that the Multi-speed shutter will give exposures of $\frac{1}{4000}$ and $\frac{1}{6000}$ of a second. Naturally these claims awaken the curiosity of the practical worker, but the booklet issued by the manufacturers offers convincing testimony of the wonderful efficiency of the new shutter. Every reader interested in the efficiency of shutter and lens work should get this booklet, which may be had for the asking.

❧

The Anthony & Scovill Company announces the removal of its New York office to 40 East 21st street, just off Fifth avenue. By this removal to enlarged quarters space is gained for the exhibition of a full line of the staples and specialties manufactured by this old-established house, including Ansco cameras, films, Cyko paper, studio equipments and the like.

Those who have not seen the new Anthony & Scovill Company's catalogue of hand-cameras for 1907 have missed one of the best trade-lists yet published. Copies may be had on request.

❧

THE PHOTO-MINIATURE No. 77, dealing with "Focal-Plane Photography," seems to fill the proverbial "long-felt want," judging by the demand from every section of the country. The issue was one which presented unusual difficulties in its preparation because of the utter lack of reliable information on the subject of focal-plane work. We are glad to know that it has proved satisfactory to so many workers who have written expressing their acknowledgment of its practical helpfulness. As the edition is rapidly disappearing, those who desire copies should apply to the nearest dealer without delay.

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We have a few copies of the new Ozobrome Manual recently issued by the Ozotype Company of London, and will be pleased to send these to readers interested in this process.

⁂

A new lens known as the Series Ic Tessar working with apertures of *f*/3.5 and *f*/4.5 is now on the market. The new series embodies all the characteristics of the Tessar *f*/6.3 together with greater speed,—in fact, the new objective is an anastigmat with the speed of a portrait lens. The new *f*/4.5 is most suitable for ultra-rapid instantaneous photography and focal-plane shutter work, while the Tessar *f*/3.5 is designed for cinematograph work and particularly for portraiture. A new Zeiss catalogue is also announced which contains full information regarding the new lens and will be mailed on request by E. B. Meyrowitz, 104 East 23d street, New York City, who is the sole United States agent for the firm of Carl Zeiss.

⁂

The Gundlach-Manhattan Optical Company, Rochester, N. Y., send their new catalogue for 1908, listing their Turner-Reich Anastigmats in symmetrical and unsymmetrical Series, the Verastigmat, the Rapid Rectigraphic, the Telo-photo Attachment and other lenses of this old-established house. Copies can be had direct from the company.

Ross "Special" Lenses

FOR

KODAKS, HAND CAMERAS

AND
ALL
GOOD
CAMERAS

These Ross "Special" Lenses are in cells, in a neat case as shown above, and fit the Kodak Automatic Shutter and other shutters.

Where special fitting to some shutters is necessary it will be furnished at a slight cost. Each lens is supplied with Speed and Focusing Scale, easily attached.

ROSS SPECIAL Homocentric . . .	5 in.	F 6.3 . .	$25.00
ROSS SPECIAL Homocentric . . .	6½ in.	F 6.3 . .	$30.00
ROSS SPECIAL Homocentric . . .	8½ in.	F 8. . .	$35.00
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ROSS-GOERZ SPECIAL III	6 in.	F 6.8 . .	$39.00
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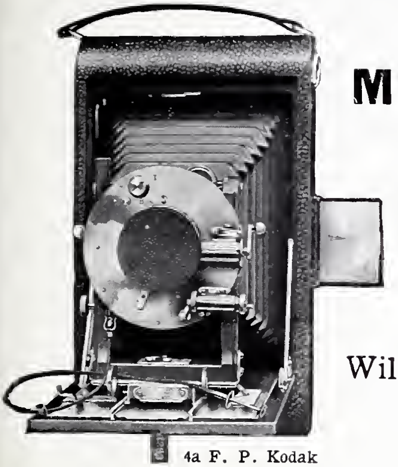

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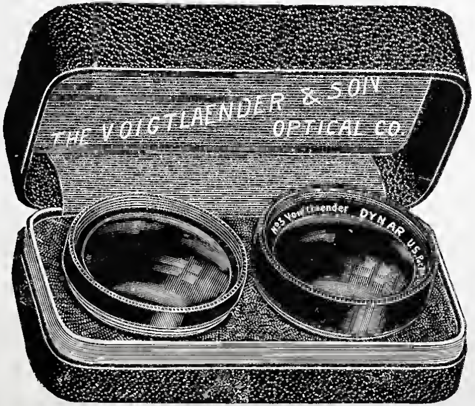

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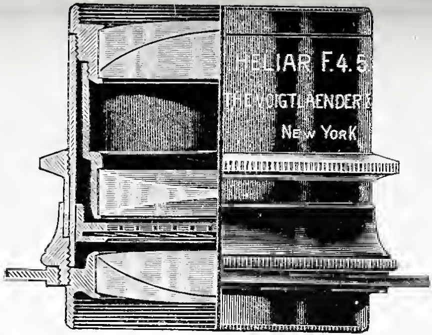

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MONSEN OF THE DESERT

In the March number of the *Craftsman* is a most entertaining article on the Hopi and Navajo Indians, by Mr. Frederick Monsen, artist and lecturer. There is probably no living man who so well understands the simple and primitive people of the Arizona plains and cañons as Mr. Monsen. So fully is he in sympathy with these people, and so long and intimately has he been associated with them, that the *Craftsman* in introducing him to its readers has most happily given him the title, "Monsen of the Desert."

Mr. Monsen's Indian talks and Indian pictures are delightful, but it is in his experience as a portrayer of Indian life by means of the camera that the photographer is most interested. In telling of this he says:

"Naturally, in those days, all the pictures I took had to be posed and focused, as there was nothing to use but the tripod camera, the slow lens and the heavy glass plates. True, these were dry plates, so I was not hampered by the paraphernalia necessary to the use of wet plates, but, as it was, the scope of my work was much limited, not only on account of the excessive weight of the instrument and plates, but also, and more particularly, because with this process it was impossible to avoid posing my subjects and making them keep still during a time exposure. When films were invented, I was, I believe, one of the first to use them in a professional way, and, although they were then by no means so reliable as they are now, they proved so indispensable to the kind of work I was doing, that I persisted in experimenting with them in spite of the fact that I failed repeatedly in my attempts to secure satisfactory results. In this way I gained my first actual experience and best practice in the instantaneous photographing of Indians, and when films were finally brought to such a degree of perfection that I could feel entirely secure in taking them out on long, difficult and expensive journeys, I began to get results such as I had never been able to achieve by the old method of using plates. A photographer who uses the large camera and plates the full size of the finished picture can seldom get either atmosphere, perspective or the freedom from consciousness that is so desirable when photographing Indians; that is, if one wishes for genuine individuality and convincing local color instead of more or less conventional or dramatic picturesqueness. The groups form themselves, melt away and change like cloud-shapes, and the best and most characteristic attitudes and groupings are absolutely impossible to obtain if one has to set up a tripod, adjust the camera, focus it, put in the plate, go over his group and pose each one until the general effect is just what he

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wants, and then take the picture. It may be an interesting and well-composed picture, but it is the photographer's idea that is expressed in it, not the artist's nor a phase of Indian life and character. By the use of the small cartridge films and the rapid action of the hand-camera, one is able to snapshot any number of charming, unconscious groups that show what the Indian is like in his daily life at home. * * * *

"In addition to this convenience for working, which puts the hand-camera almost on a level of a fountain pen carried for hasty notes, there are two other reasons why the small hand-camera and cartridge films are so desirable for the Desert photographer. The first is purely practical, it reduces the weight of one's equipment for a reasonably long journey about 90 per cent, a matter worth considering when one travels in a rough and little-known country. The second concerns the artistic quality of the large, finished picture. I have found that a direct print made from a large negative taken in the burning sunlight of Arizona or New Mexico is apt to be so sharp that it looks flat and hard, and seems to possess but little atmosphere or artistic feeling. By enlarging the picture from a small negative, I not only obtain a sense of perspective that gives some idea of the vast distances, but find myself able to produce a picture that, by its softness of outline and the effect of mellow, diffused light and deep, velvety shadows, conveys the feeling of all the sunshine and color that go to make up the characteristic atmosphere of the Desert."

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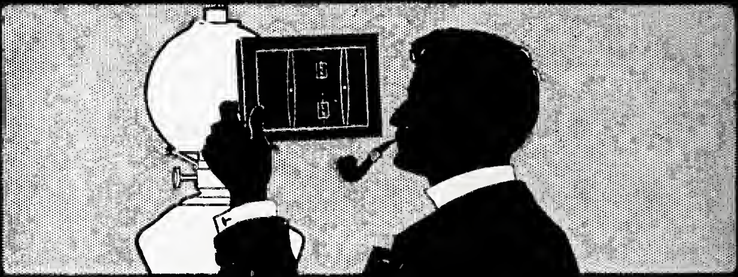

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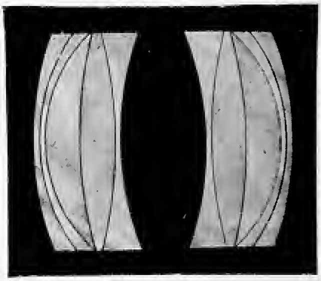

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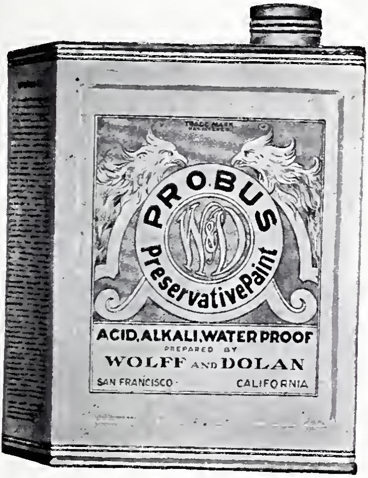

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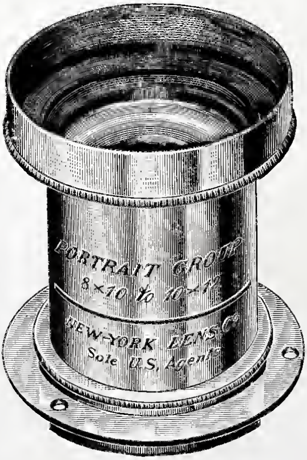

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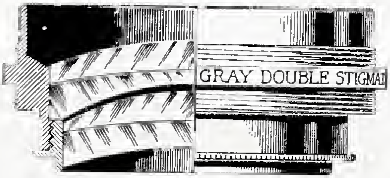

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Volume VII APRIL, 1907 Number 80

A First Book of Outdoor Photography

Next to the standing wonder of the simplicity of photography is the wonder of its many possibilities of failure. The beginner who develops his first negative has a glimpse of a mystery which never quite loses its thrill, however long he may follow his hobby; but, as negative follows negative, disappointment tempers the wonder. There are many causes of failure, and to enumerate them all would tax the limits of this little book; we will endeavor to indicate a few of them and to give a few hints by which they may be minimized. Although there are many thousands of earnest workers who treat photography seriously, pursuing it through many special phases which necessitate both skilled work and high-priced apparatus, there are other thousands to whom photography is merely a pleasing hobby, a means of securing pictures and records for present and future happiness, and to whom such hints will be useful.

There are many problems which need never trouble the "man in the street" or rather, the man in the open air. There are, of course, limitations to the possibilities of photography when followed for occasional pleasure and with a moderately-priced outfit, but limitation is not necessarily deprivation. The man with a canoe does not bewail his lack of coal-carrying capacity, any more than the owner of a steam launch bemoans his inability to ascend a shallow, rippling stream. A cheap hand-camera has possibilities for much successful and interesting work, and when a worker casts aside such a tool, and in disgust forswears photography, the fault lies not in the despised box, but rather in the worker, who has either attempted the impossible or has been following his hobby carelessly. The worker who understands the handling and limitations of a cheap camera will find it a source of continual pleasure; and when it is laid aside it will be because its owner aspires to higher things, not because photography seems a gambling waste of money. Our aim in this issue of THE PHOTO-MINIATURE will be to consider more particularly the need of the would-be photographer who has had little or no experience, and whose outfit is limited to the commercial camera which is sold at a reasonable price, with a lens attached.

Hand- or Stand-Camera

There are several points worthy of consideration in choosing a camera. For the present we will ignore the many adaptations, useful for some special branch of work, which are used by experienced photographers, but which do not affect beginners. First comes the choice of hand- or stand-camera. The hand-camera is usually chosen on account of its convenience and lightness, but it has one great limitation. It cannot be held steadily in the hand for an exposure of more than one-fifth of a second—and not for so long until after considerable practice—and so it cannot be used in very dull weather or with subjects which require long exposures. This defect may sometimes be overcome by resting the camera on a wall or post, or even by holding it pressed against a tree. Fortunately, most hand-cameras have a sunk thread let into the case, by which they may be attached to a tripod.

Size

Size has an important bearing on portability and on after-cost. The expense of snapping a 5 x 7 camera is nearly double that of snapping a 4 x 5, and an exposure in a Brownie is much cheaper than either. It is a safe rule for the beginner to commence with a small instrument, for, whatever his choice, sooner or later he will aspire to some different camera. A 3¼ x 4¼ camera, or one of the very convenient postal-card size (3¼ x 5½) is very suitable.

Lens: Working Aperture The question of make of lens need not trouble us at this stage. All popular hand-cameras have lenses attached, and these lenses are sufficient for their purpose. A serviceable camera costing $15 to $20 may have a $40 lens attached, raising its price to over $60. This special lens is a luxury which may come when the photographer knows sufficient about his hobby to understand and appreciate its wider capabilities. The only vital point to be noted at present is the working aperture of the lens. If possible, a camera should be chosen with a lens working at *f*/8, or, if this is too expensive, one working at *f*/11. Many of the cheaper "fixed-focus" cameras are fitted with a lens working about *f*/16. As an *f*/8 stop passes twice as much light in a given time as an *f*/11, and four times as much as an *f*/16, the quicker lens gives a wider usefulness to the camera, making it twice or four times as swift. The *f*-value of a stop is easily found. The rule is to measure the distance between the lens and the plate when the camera is focused on a distant object, and divide it by the diameter of the lens aperture. Thus, the lens of a camera with an extension of eight inches would need to pass light from an opening of one inch in diameter to work at *f*/8. In a camera extending six inches the opening would be three-quarters of an inch. This shows that the rapidity of a lens is not dependent on size of lens aperture, but is a proportional quantity. In most makes of cheap hand-cameras—other than fixed-focus cameras—the focal length (the distance between the lens and plate) is from 5½ to 7 inches, according to the pattern of the camera; so without exact measurements the difference between the *f*/8 and the *f*/11 stops can be seen. The former will be about three-fourths of an inch, or about the size of a nickel, while *f*/11 will be fully one-eighth of an inch less, or about the size of a dime. In many cameras the *f*-values are marked on an adjusting scale in front of the lens. Kodaks are marked with U. S. (Uniform System) numbers instead of *f*-

values. U. S. No. 4 is equal to f/8, U. S. No. 8 to f/11, and U. S. No. 16 to f/16.

Plates or Films

Finally, there is the question of plate- or film-camera. As regards reliability or speed of working, there is nothing to choose between the two. The great factors in favor of films are their lightness, convenience and portability. Plates are heavier and more bulky. A film spool sufficient for one dozen exposures may be placed in a camera and the camera folded to fit a pocket, where it is so light that its weight is not noticed. A camera loaded with one dozen plates must be carried in the hand, and if plates are carried separately they must be placed in holders. It is easier and speedier to substitute a new film spool for an exposed one than to substitute a dozen plates. The former may be done in the open air; the latter often requires the use of a dark-room. Films are less bulky than plates and they are practically unbreakable, but the cost of plates is less than that of films.

Using the Camera

A hand-camera is so simple in its working that mistakes would appear improbable. But in practice, it is very easy to spoil plates. Before any actual work is attempted with a camera, its manipulation should be practiced until every detail is familiar. Before an exposure is made, the length of exposure to be given and the size of stop to be used should be decided on; and the correct focusing should be attended to. In all cameras, but particularly in those fitted with roll films, there is a possibility of forgetting whether a plate has been exposed or not and getting double exposures on some plates and none on others. There should be a careful method in changing plates or films. Our rule with roll films or a magazine camera is to make the change immediately after exposure. When plate-holders are used they should be numbered and used consecutively; the last plate exposed being marked on its holder with pencil or a small piece of gummed label.

Focusing

Unless a "fixed-focus" box-camera is used, the lens must be correctly focused before exposure. With a fixed-focus camera it is sufficient to guard against being too near the object photographed—the minimum is usually from eight to twelve feet, according to the make of camera. In adjustable hand-cameras the focus for different distances is usually marked on a celluloid scale fixed to the camera, and the camera bellows is drawn out until an indicator points to the required distance. With beginners the tendency is to forget about focusing. They work with a view-finder and forget that this is a fixed-focus contrivance. It shows them their picture clear and distinct, whether at five or one hundred feet, and shows the picture, too, full of brilliant color and motion; and so they forget that the lens and the finder do not work in accord and snap their shutter with disappointing results. It will be noted on a focusing scale that the difference between six and eight feet is as much as between seventy-five and one hundred feet; and it is with objects close to the camera, which will photograph large and be expected to show detail, that we require the most accurate adjustment.

Judging Distances

When we have learned to remember the focusing scale, there crops up the difficulty of judging distances. Many people cannot judge between eight and eleven feet, or between twenty-five and forty. This is merely a matter requiring a little practice. Estimate the distance of some object, and then measure it carefully to see how far the estimate is wide of the mark. The more familiar we are with every detail of manipulation, the more we can concentrate our attention on the object to be photographed. A quick eye for distances is necessary when we take pictures of moving objects approaching or leaving the camera. Then the exposure must be made at the exact moment or the picture is lost.

"Depth of Focus."

Fortunately for us, photography is an art allowing of much latitude. The question of focusing is simplified by the fact that when a lens is focused at any given distance, objects at both less and greater distance are, within certain limits, also in focus. This "depth of focus" is the greater as the lens opening is smaller. Thus a pinhole is correctly focused for any distance, while a professional portraitist's lens, which works with a very large aperture in order to gain speed, has such slight depth that when a face is sharply focused the ears may be a little indistinct. With a camera of five inches focal length, such as the No. 3 F. P. K., and using the *f*/8 stop, we get everything sharp from six to eleven feet from the camera, when focusing for eight feet; when focusing for twenty feet, everything from eleven to eighty-seven feet will be in focus. If we stop down to *f*/11, everything from six to thirteen feet is clearly defined when focusing for eight feet; and when we focus for twenty feet it becomes practically a fixed-focus camera, rendering everything sharp which is more than ten feet from the camera. So, while focusing becomes a delicate matter when working with a lens with a very large aperture, it is simplified for the hand-camera worker. If only he alters his focus after taking a group, before exposing on a distant landscape, or vice versa, he will be fairly sure to be right.

Exposure

The focusing learned, there remains the question of exposure. Most failures are due to wrong exposure and most frequently to under-exposure. Exposure is often looked upon as an intricate problem; but the idea is a survival of old days, when the subject had received but little consideration, and had to be learned through hard experience. The question is now reduced almost to a matter of simple arithmetic, and can be learned from one of the several cards or exposure tables on the market. The "Photo-Beacon" exposure tables are the best known of these, and the worker who follows their figures—they can be understood with five minutes' study—will obtain correct exposures. The amount of exposure required for any given subject depends upon a number of factors, such as the nature of the subject itself, the condition of the light, the time of day and year, the plate used, and the stop. This may seem a formidable list, but in practice it works down to simplicity. Plates may be divided into three classes—very rapid, rapid and medium rapidity. Roll films are made in two speeds, equal to very rapid and medium-rapid plates. The hand-camera worker should use the very rapid plates or films.

The Unit For obvious reasons (broader and more diffused lighting, etc.,) distant scenes require less exposure than those near the camera. The usual unit taken in calculating exposures is an "open landscape" in which there is no prominent foreground object nearer to the camera than, say twenty-five feet. A picture which is "all foreground," such as a group of friends seated a few yards from the camera, or a portrait, will require twice as much exposure as the "open landscape;" but a landscape of distant scenery without any tree or other object to break the distance will require only one-half the exposure; and very distant, light views—such as clouds or sea—only about one-eighth the exposure of the open landscape.

Light Conditions It will be seen from this that the nature of the subject has a wide effect on the correct exposure. Another factor to be considered is the light. In order to get our unit we will suppose we are working in brilliant sunlight. If the sun is slightly veiled by clouds, but still bright, double the exposure needed for brilliant sunlight will be required; on a dull day, three times the exposure; and on a very dull day, four or five times the exposure. There is only one other factor which need trouble us at present, and that is the time, hour and month. In northern latitudes an exposure at midday in December requires four times as long as an exposure at midday in June; and an exposure at four oclock in the afternoon of a June day requires almost twice as long as an exposure made at noon on the same day.

An Example Let us take a landscape with the nearest foreground object about thirty feet away, using *f*/11 stop with a fast plate, in brilliant sunshine in June. A sufficient exposure would be $\frac{1}{50}$th of a second; and using *f*/16 stop, the exposure would be doubled, requiring $\frac{1}{25}$th of a second. In taking a photograph of a group or street scene where part of the road is in shadow and there are figures near the camera, and with the other factors the same as before, *f*/11 stop would require $\frac{1}{10}$th of a second. If *f*/16 stop was used the exposure required would be $\frac{1}{5}$th of a second. As we are choosing here the most favorable times in regard to light, time of day and year, it will be seen that a camera using $f/16$ lens has considerable limitations, and the photographer must keep it for bright days and favorable conditions of light and subject, or else use it in conjunction with a tripod.

The Latitude of the Plate

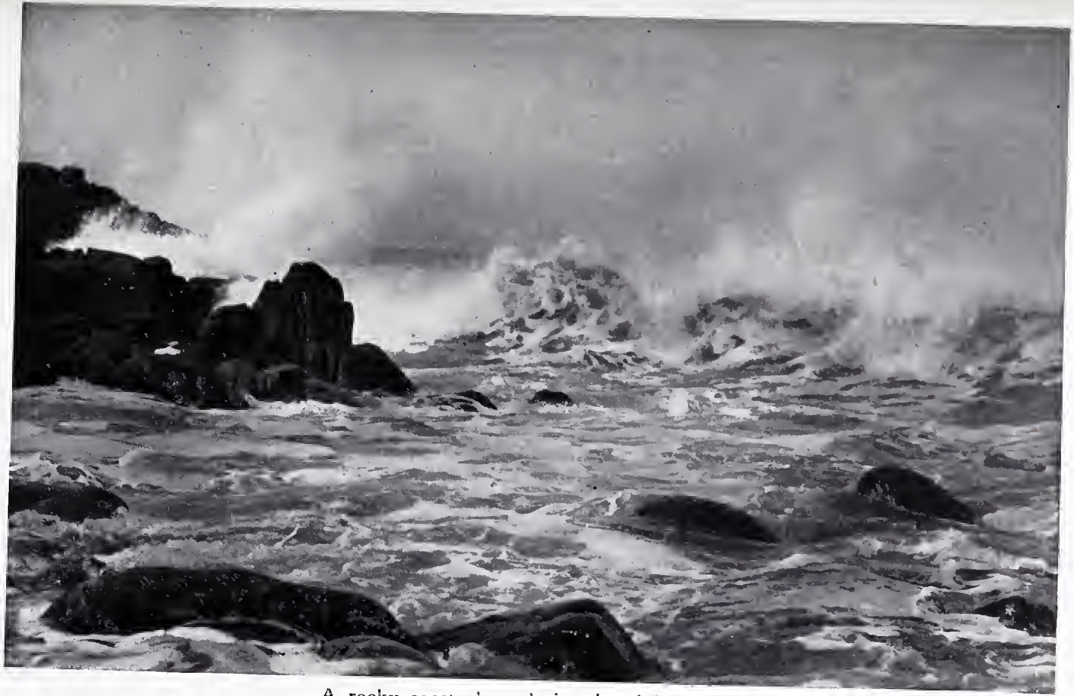
If a correct exposure were essential to the production of a negative, there would be many more spoiled plates than there are. But a plate which has received scarcely one-tenth of a correct exposure will yield a recognizable print. The object chosen has been, say, a house and lawn. The lighted parts of the house are fairly rendered, but the shadows are black masses. The trees on the lawn are black silhouettes against a rather lighter ground; and the sky at least is sufficiently exposed. The undiscriminating photographer recognizes his print and is content. But he will continue making such unsatisfactory pictures, interspersed with occasional lucky successes, until he grapples with the question of exposure.

Holding the Camera

During exposure, the camera should be held at the height of the eye to give the most nearly correct representation of the object photographed. But most view-finders are so fixed that they must be looked down into, and so the camera must be held lower. Hold it steadily against the chest, or under one arm, and stand as still as possible while releasing the shutter. It is quite easy to move during an exposure and so spoil the picture; or the camera may be jarred when pressing the spring. A box-camera can be held at eye-level and the object sighted by looking along the top. This is a safe and easy method of obtaining the picture and is the one recommended by the Eastman Company for their Brownie cameras. On these little boxes two lines are embossed, V shaped, which show the photographer just what width of picture reaches the film.

Orthochromatic Plates

In adding a note here on orthochromatic plates we are not departing from our intention of making this article elementary. "Ordinary" plates are very sensitive to blue, slightly sensitive to green, and almost insensitive to red. So that when we expose a plate the blue or bluish objects photographed are fully exposed when the



A rocky coast abounds in pictorial subjects
F. J. Mortimer

Bird-nesting with a camera is delightful sport
L. F. Brehmer

green are underexposed, and the red scarcely recorded on the plate. Fortunately for photography, objects reflect a certain amount of light other than that of their prevailing color; thus a red object will reflect a certain proportion of white light, and this acts on the plate. But it only modifies the trouble. We find this defect a very real one in outdoor photography where green is the predominant color. Many a photographer has been attracted by the various delicate greens of spring foliage, only to find them disappointingly dark in the print. Plate-makers have found that by bathing a plate in certain dyes it can be made more sensitive to the yellow and green rays. But they have not found a way to sufficiently check the over-active blue rays. There are also "ultra violet" rays to contend with. These are color rays beyond the violet rays of the spectrum, invisible to the eye, which act on sensitive plates.

Color Screens

To retard these blue and violet rays, and give the green and yellow time to act on the orthochromatic plate, color screens are used. These are pieces of glass which, placed before the lens, check the undesirable rays, without affecting the others. In practice it has been found that green glass is unsuitable for general use, as it stops the yellow as well as the blue rays, Yellow is the color employed, and to obtain satisfactory results specially prepared screens should be used. There are a number of screens on the market of different tints and densities which lengthen the exposure from four to twenty or more times. Advanced workers usually have several, and select one according to the nature and lighting of their subject. The quickest filter which is fully corrected will increase the exposure quite eight times; but there are screens on the market which may be used with a three-times exposure, and these, while not fully correcting the blue rays, are still a very useful help where long exposures cannot be given.

Summing Up

From the foregoing pages we may conclude that photography has been specially designed to be easy for the beginner; that there is such a latitude in working as to insure a fair amount of success to any worker who is even reasonably careful; and that with a little care given to understanding elementary principles, success is reasonably certain.

Movement To photograph moving objects is the ambition of nearly every photographer, and usually his desires run towards high-speed movements. Hard figures demonstrate to us that many subjects are beyond the reach of the beginner's camera. But there are plenty of subjects left, and there are ways of evading difficulties to a certain extent, if we wish. A photographer may rouse our envy by obtaining a sharp negative of a train traveling a mile a minute, but except for the blur of dust which it raises, and perhaps a depressed trail of smoke, there is nothing to show that the exposure was not made when the train was motionless. As far as pictorial value is concerned, it would be preferable to take the train when just moving out from a station, for then we miss the trailing dust and get better masses of smoke or steam from the engine.

Movement is usually intermittent, and the pauses in it are the most familiar part to us. We see a photograph of a dog running at high speed and think, "how curious," as we notice the four feet bunched under the arched back; the same dog is photographed, panting, at the end of his race, and we think, "how natural." By remembering the limitations of our camera, and selecting the correct moment for exposure, we shall find that many interesting, moving objects which at first sight seem impossible are within our power.

Camera Speeds With all subjects including movement we are limited to "snap-shot" exposures. Most fixed-focus cameras, and some other low-priced cameras, have shutters which are set to one rapid speed only. This usually varies from $\frac{1}{30}$th to $\frac{1}{50}$th of a second. Others have an adjusting scale by which the exposure may be regulated, giving speeds varying from $\frac{1}{100}$th to $\frac{1}{5}$th of a second. These speeds are not always quite correct as indicated on the dial. If one speed which should give sufficient exposure does not do so, or if a speed that is calculated not to show motion does so, the matter may be regulated by experience. A slower speed, or a larger stop, may do away with the under exposure, and movement may be avoided by increasing the speed; or, if we have a one-speed shutter, by getting further from the object, or tackling it at a different angle. If we realize that our object is not the registering of movement—or of "arrested motion"—at any given speed, but rather the obtaining of pictures suggestive of natural life and movement, we shall find many interesting subjects available for our camera.

A Few Figures

We do not get *absolutely* sharp photographs of moving objects. The image is moving across the plate during exposure, and it is a question of how much movement. It is found that the eye cannot detect any blur or double image until the object has moved, on the plate, more than $\frac{1}{100}$th of an inch. Let us make a few calculations, using a camera with a lens of seven inches focal length. We choose this length because most small hand-cameras are of this or shorter focal length, and, if the calculations are applied to them, they will come well within the work; and the shorter the focal length, the greater will be the margin of safety. A lens of seven inches focal length focused on an object twenty-five feet away, will represent it $\frac{1}{45}$th its full size; at fifty feet the object will appear $\frac{1}{90}$th its size; and, at one hundred feet, $\frac{1}{180}$th its size. Now a motor-car traveling at nine miles an hour moves one hundred and fifty inches per second; or, if the car is twelve feet long, it moves its own length and six inches over every second. On the plate the image at one hundred feet will be about $\frac{4}{5}$ths of an inch in length, and will move just as far in the second. From this, by a simple calculation, we find that the image will move $\frac{1}{100}$th of an inch in $\frac{1}{80}$th of a second, and that, therefore, is the longest exposure we can give. Now our shutter works at $\frac{1}{75}$th or $\frac{1}{50}$th of a second. The former speed will probably woefully under-expose our picture, and, even if the latter gives sufficient exposure, it will give a blurred picture. And if we wish a larger photograph of the car, and expose at fifty feet distance instead of one hundred feet, we get double the apparent movement, and our exposure must be about $\frac{1}{150}$th of a second—an altogether impossible proposition with the majority of lens shutters. This is a typical example of the limitations of our camera. With a high-priced lens, working at, say, *f*/5.8, and a focal-plane shutter, we could picture the motor when tearing along at racing speed—but we are not considering high-priced lenses and expert manipulation, at present.

To Photograph a Motor-Car

It is evident that we must moderate our ambition somewhat. If we merely wish a photograph of some particular motor-car, the simplest way is to take it when standing still, and then we may have it the full size of the plate, if we wish. But if we want to take a moving car, we can double our exposure by waiting for one traveling at five instead of nine miles an hour. So far we have considered the car as though it were moving at right angles to the camera, but probably the photographer's idea is to capture one as it approaches him. Now an object moving toward, or receding from, the camera at an angle of 60° has scarcely half the apparent motion of one moving at right angle to it. And if the car is taken almost head on as it approaches the camera, the movement will be still less; so, instead of giving $\frac{1}{75}$th of a second, we can safely give an exposure of $\frac{1}{25}$th of a second, on the car, one hundred feet away, as it travels toward us at nine miles an hour.

Photographing from Moving Objects

The photographer who is well advised will not attempt snap-shots from a traveling automobile or railroad car; or, if he is curious to do so, will content himself with a distant scene. For in a train we have, in addition to the travel motion, the vibration of the car itself, which forms a very unstable support for the camera.

From Steamboats

This is very much easier, and has more pictorial possibilities, from the decks of large boats. Ocean-going boats, when away from land, offer little photographically except scenes on board; but from large ferry-boats, or the steamers on our lakes and rivers, the possibilities are endless. The boat moves steadily through smooth water; it is usually close to the shore, and frequently meeting or overtaking other craft. The large size of the boat gives us a double vantage, for we may obtain a favorable view-point from an upper deck ; and the size takes away the feeling of restless speed, which we would feel in a smaller conveyance, and so allows us to go leisurely to work. When leaving or entering port, the scene is gradually changing moment by moment, but the boat glides so smoothly that we have time to see our picture, and then snap it before it is too late. The rules about moving objects hold good on the water, and they may be accentuated by the boat and the object photographed, both moving, and in opposite direction. If our boat moves at eight miles an hour and one approaches it at the same speed, the combined movement is sixteen miles an hour. Boats, however, are the least pictorial when broadside on, and look best when approaching or receding at a fairly acute angle. As they are large objects, they are best taken at some little distance from the camera. And so, in practice, we find that with a moderately rapid exposure we get no trace of movement. When exposing, do not rest the camera on a rail, or other part of the boat. Hold it firmly in the hand, and be careful that no post, or other part of the boat itself, comes in front of the lens.

Pictorial Work

A first lesson in pictorial photography may well be learned from the deck of a boat. Simplicity and concentration of interest can be so often obtained in these pictures. We photograph some object on the water—it may be a passing boat, or a tiny islet—and around it we have the water and the sky ; or, if there is a shore, it is probably unobtrusive. We get rid of the score of irrelevant details which bother us so much when we wish to obtain a picture on land. The best work from a boat—from a pictorial point—is done in the morning or afternoon ; in fact, except in special cases, it is a good all-round rule to take a rest from work during the noon hours, for then the intensity of light, and the shortness of shadows are against good work. On board boat exposures may be made earlier and later than on land, for we are working in the open air, with no shadows or near objects to trouble us, and the reflection of light from the water tends to shorten exposure. It is, indeed, difficult to under-expose such subjects, given ordinarily favorable light conditions.

Town Photography

Having digressed to take a water-journey, let us return to town. There is something fascinating in prowling around streets on the lookout for interesting bits. Let us dismiss from our minds any thoughts of galloping horses, or high-speed trolley cars, and be content with the quieter aspect of things. Streets lend themselves to pictorial effects, if we care to look down their vistas. In street work we find the advantage of understanding the working of our camera. For we must work quickly when a scene is found, and we should do so with a certain amount of secrecy. We wish to get natural views, and to do this no person who is in the view must notice us, or we shall find pictures with people staring at the camera; and one such conscious person will quite ruin any pictorial quality in our photograph. In street views no figure should be in the immediate foreground. If one person looms three inches high on the plate, and others are less than an inch, the large figure detracts from the street by catching and claiming the attention of the eye. Such a large figure is too near to be in correct focus; is usually dark and under-exposed, probably shows blurred signs of movement and may be only partly on the plate. Quite a collection of evils for one unlucky object! Using a lens of six inches focal length, a person thirty feet away will be about one inch high on the plate; with a fixed-focus camera he will be still smaller. If we select such a subject, and give $\frac{1}{25}$ of a second exposure, we are fairly safe from apparent movement. If a person happens to cross the street at right angles to the camera, we may get traces of movement; and side-views of people walking sometimes give us some quaint attitudes of limb. But if people move toward or from the camera they will usually look natural.

Street Groups

Town photography is not confined to street vistas. The group on the sidewalks, or around the shops, are often full of interest; but here our limitations must be more carefully considered, for we are working near our margin of possibilities—that is, if we want fully exposed pictures. Note a group haggling around a store under the shade of an awning. The sun may be shining brightly, but they are in shadow, and probably their clothes make them dark objects. As they are the motif for the picture, we wish to get them fairly large on our plate. At fifteen feet range, a figure of a woman will be about two inches high and at this distance becomes a "foreground" object, requiring a longer exposure than a distant one. All these points are to be considered, and, in addition, we must take our picture without letting the people know. On reference to our exposure tables we find that an exposure of $\frac{1}{10}$ of a second with *f* 8 will be required, and this means standing firmly while exposing. This is a typical scene and one that is frequently "snap-shotted." If we did "snapshot" it we would probably get a recognizable photograph, but it would be a distinctly amateur effect, with the shadows appearing as transparent glass in the negative, and as black patches in the print. I have taken pictures of children seated on the sidewalk and busy with some game with an exposure of $\frac{1}{5}$ of a second. In group work of this kind, long "instantaneous" exposures can often be given, for people are not invariably on the move. The period of rest in every sort of motion is the big vantage-point in all these subjects.

Holiday Groups

A camera is an ideal adjunct to a holiday. Given a few film spools, or a few boxes of plates, and we are fairly certain, barring accidents, to return with pleasant memories of our vacation. These memories will be all the more satisfying if a little care is taken in arranging and lighting the groups, and in giving a correct exposure. In photographing a group of several people, it is well not to let them quite fill the plate; make the figures a little smaller, and the picture will look better. With groups of not more than five or six people, we may get natural pictures. With one or two chairs, or a log, or a hammock, and with some of the people content to be photographed in profile, they may be arranged as though engaged in their lawful avocations or amusements. With a large number of people we must frankly recognize that they are being posed and photographed, and arrange them before the camera in more or less the conventional fashion—row standing, row sitting, row reclining. Small groups should be taken in the shade, in preference to sunlight. The sunlight will tend to give us half-closed, frowning eyes, in those whose eyes feel the glare. And with parts of faces in sun, and parts in shadow, we may get hard black and white patches in our prints. Pose the sitters under the shade of a tree, or in the entrance to a tent, or when the sun is clouded — and give sufficient exposure. In the absence of a tripod, a stand should be built of a couple of boxes, or whatever may be handy, and the full exposure given according to the exposure tables. Use *f*/11 stop in preference to *f*/8; it will give greater "depth of focus," and bring the surroundings into clear range, for in a holiday group, we want it all in the picture.

Sunlight

Very effective sunlight portraits may be taken, but the contrast between the bright high lights and the soft shadows require a full exposure and careful development. Such pictures fairly come within the scope of elementary photography, but they are not obtained by hap-hazard snap-shotting. Very pretty pictures of girls may be obtained by the use of a sunshade, which softens and shades the light on the face, and, at the same time, adds to the general sunny expression of the picture. The parasol should be white or light-colored; a red parasol would make the face too dark.

Children

Children are a never-failing source of interest to camera workers. Childhood is so spontaneous and natural as to be full of picture possibilities; and when the children are not merely children, but one's own, or children in whom one is interested, the possibilities become irresistible. The subject, for our present purpose; may be divided into two parts. First, children who are conscious of the camera, and who are posed. These may be standing or seated, and they may be engaged in some childish pleasure, as feeding a rabbit or taking tea on the lawn. Let them be natural, and let the exposure be rapid, so that even through the moment of exposure there is no

The suburban garden has many possibilities
Jean M. Hutchinson

Woodland scenes require softly diffused illumination

W. H. Wallace

First American Salon

strained standing at attention. Second, there are snapshots taken while "stalking" the child, following it with a camera, and releasing the shutter at the happy moment. In the summer months, the best time for photographing children is before ten and after three. During the noon hours the sun is too high and too hot. In spring or autumn the rule may be relaxed. Unless we are after sunlight effects, exposures should be made when the sun is just obscured by a cloud. With a bright diffused light and *f*/8 stop we may get full exposure with a "slow snap," probably $\frac{1}{10}$th or $\frac{1}{15}$th of a second. But the negatives must be fully exposed, and, as we are working in the morning and afternoon hours, we may easily try a subject a little beyond the reach of our camera. And so a reference to the exposure tables may prevent disappointment.

Animals

Camera workers who live in large cities are fond of visiting the local zoological collection, where they expose plates with a very moderate degree of success. Many animals are of a brown or tawny color—inclining towards the insensitive end of the spectrum—and even when out-of-doors they are frequently in a shaded or subdued light. The animal must be a fair size on the plate, and so the exposure is made at short range; and the combined effect of these troubles is that we get under-exposure. A picture of an animal is not satisfactory unless the texture of the fur shows, and this it will not do in an under-exposed print. There is no royal road to success here—the chief requirement is patience. Do not endeavor to get too large a figure in the negative, focus carefully, and make the exposure when the animal is at rest. Rules have been laid down that an animal photograph should show all four legs, feet and tail, also the mane, if any, and that the head, including the hairs, should be microscopically sharp. Such rules may be useful for makers of natural history studies, but they do not affect us here.

Pastoral Scenes

Domestic animals offer wide opportunities to the camerist. Home pets may be snap-shotted, much as children are, by stalking them, and releasing the shutter at the right moment. To fix a tripod and pose an animal is difficult work, or rather work requiring considerable patience. Field subjects of animals are always popular. Sheep have for years been a favorite subject, because years ago they were found to be "pictorial," and photographs of them received honor in exhibitions. They have usually been treated as groups, without any attempt at microscopic detail in the individual animals. Cattle, owing to their different movements and their individual markings, are usually photographed not as a mass, but as a collection of individual creatures. The only reason for these animal groups is their pictorial possibilities. Sheep may be coming down a glade, or moving under trees, and are often very effective under a morning or evening light. Cattle are well set off by water, standing in or crossing a stream or pool.

Domestic Fowls and Animals

Chickens, ducks and farmyard poultry generally, are not difficult to photograph, if a little time is given to the task. A bright day with the sun slightly veiled is the best light, and with a $\frac{1}{10}$th second exposure, while they are feeding. Success with moving animals and birds is largely a matter of seizing the right moment. Their general movements are leisurely, but some of their actions are extremely quick. We may find a foot or even a head missing in our negative, but usually, with care, we get what we want. Kittens or puppies at play may yield a greater percentage of failures, as their movements are more active. Watch your opportunity for the exposure. It is better to choose a soft light and a fairly long exposure, than to make a rapid snap in brilliant light. For we must get fully exposed soft negatives if our results are to please.

Birds' Nests

The photographer who, afield in the spring, finds a bird's nest, wants to photograph it. If the nest is on the ground or in a low bush, this is not difficult. Time exposures must be given. Set up the camera from eight to twelve inches higher than the nest. The eggs are the point of interest, and with the camera looking slightly down, both the inside and the outside of the nest can be shown, and a correct idea of its construction given. Some small nests are very deep, and to see all the eggs the camera must look almost vertically down. As a picture thus taken looks unnatural, we may compromise a little by raising the eggs on a tuft of cotton, taking care that the cotton does not show, and also that the eggs are not raised too much, or the nest will look unnaturally shallow. A few twigs may have to be bent away, or the grass pressed down, to give a clear view. Do not move or tilt the nest. Focus sharply on the eggs, and stop the lens down to *f*/11 or *f*/16 to bring the surroundings into focus. This means a time exposure, and so a still day is necessary, or the surrounding leaves will stir. If in direct sunlight, a shade must be held over the nest—a handkerchief will do—or the full detail will not show in the markings of the eggs.

Young Birds

Given favorable conditions, the photographing of young birds is not unduly difficult. Here we must use rapid exposures, for even if the little creatures sit still they breathe rapidly, and so blur their down or budding feathers. The camera may be focused on the nest as when photographing the eggs. Just before the birds are ready to leave the nest they offer new possibilities, for they may be handled and placed on some limb, where the chances are that they will stay. Focus the camera sharply on the chosen branch, place the birds there and expose. It is well to be content at first with one bird, but with a little experience we may get the whole of the young family in line.

Pictures of birds in flight, or feeding their young, come under the head of more serious work, calling for special apparatus, and for an amount of patient work only possible to enthusiasm. If a camera is left in position near a nest of young birds and the photographer moves away, the parent birds will return to feed their young and a snap-shot of them may be obtained. Use *f*/8 stop and give $\frac{1}{10}$th second exposure. A thread should be tied to the shutter release and pulled by the photographer, in hiding some little distance away. A thread is better than string, as the latter if pulled too hard may shake the camera; thread will snap instead.

Landscape Photography

So far, we have dealt with the photography of living or moving objects; a branch of work in which hand-camera speed and portability are desirable. In landscape photography there are more occasions when the use of a tripod is necessary. Snap-shot work is a matter of seizing the passing incident; prompt decision and quick camera manipulation are required, for the object is moving all the time, and in a moment may be gone. In landscape work our first desire is, often, a picture. Nothing is to be gained by haste; we must study and criticise our view, look at it from various points giving differences of arrangement and light, and finally select the best. The real pleasure of landscape photography begins not with the exposure, but with the preliminary work—the study and selection of the subject; and the more care put into these the greater is the anticipatory pleasure in following the negative through development and printing, and the satisfaction with the final print.

The View-point

The success of a picture depends largely on a careful selection of view-point. Our subject may have for its principal interest a building or a waterfall, or it may be a mere view—a woodland glade or a stretch of country selected for its beauty. In either case we shall find that it has many aspects, and that some are palpably better than others. Let us consider a scene with a building as the center of interest; probably it has a "front" or one part which should certainly appear in the picture. Look at the building directly from the front and then see whether it would not be better to choose a corner view, showing the front and one side, both in perspective. It may be a building with a high tower, or an old-fashioned house with quaint chimneys and a restful stretch of roof, and, if so, we must be far enough away to render these things naturally. There is a rule that a building should be photographed from a distance of three times its height. It is a good rule, but one that was enunciated before the advent of compact hand-cameras, and so we need not follow it literally. The light must be considered; if the front of the building is all in shadow, or all in sunshine, it may appear flat. A diagonal lighting with bold shadows is often good pictorially. At certain times the light may be flecked on the building through trees, and this may make or mar the picture. It may be that a building surrounded by trees can best be photographed in winter, or in early spring when the trees are budding with green but before the leaves have become thick. But we have said enough to emphasize the importance of the point of view.

Composition

This is not a treatise on art photography, but we will give one or two of the simplest rules to be observed by those who desire to get any pictorial quality in their work. We have just shown how choice of lighting, viewpoint, or even season may affect a picture. The first rule of composition is that symmetrical balance is not advisable in a picture. The sky-line, which is present in most landscape pictures, should not cut across the center of the picture, dividing it into equal parts. It is better to let the sky occupy either one-third or two-thirds of the picture. In distant subjects, such as views of extensive country or lake, the horizon line may be low, giving two-thirds of the picture to sky; in nearer "foreground" subjects the line may be raised, making the sky one-third only. Of course, rules are suggestive rather than absolute; more often than not the sky-line is uneven and we may even have a well-balanced picture in which the sky-line runs across the plate from an upper corner to the opposite lower one.

The Principal Object

The principal object in a picture should not be in the center, nor should it be too near the edge. As far as a rule can be given, it should be about two-fifths from one side of the plate. Thus, if we photograph a house, choosing a side view so that we see the front and one end, the house should be to one side of the center, with the greater space in front of the house. In photographing a view with a road in it, we spoil our picture by standing in the center of the road and representing it as an inverted V, dividing the picture. We should move a little to one side and represent the road running diagonally across the plate; probably with a bush or strip of grassy road-side in the foreground.

Shadows

The noon hours are not the best for photography. Earlier or later the light is softer and less glaring, and when the sun is lower we get longer shadows which are often useful in a picture. A golden rule in photography is to expose long enough to get detail in the shadows. Unless shadows are transparent,—that is, unless we can see the objects in shadow—the photograph is of little pictorial value. Under-exposed prints, giving solid black shadows, are frequent in elementary amateur photography. While we are sufficiently exposing our shadows we are over-exposing the high lights, but this is a lesser evil. A developer may be used which will bring up detail in fully-exposed shadows without clogging or over-developing the lighter parts; but no developer can bring detail from under-exposed plates.

Lighting

In some ways brilliant sunlight is bad, photographically. When we are photographing trees we may have a thousand tiny reflections from glossy leaves, and these many points of light destroy any feeling of restfulness in the picture. The trouble is sometimes found in an aggravated form when photographing a child or some person in a garden. These are often posed before a laurel or some bush with shiny leaves, and the nearness of these cause the white reflections to be unpleasantly obvious. The difficulty can be avoided in portraiture by posing the figure before some bush without the reflecting leaves. In landscape work we must be careful not to choose a sparkling subject. If some beauty or arrangement of the trees particularly pleases, the subject should be noted and returned to at a more favorable time. A cloudy day or the soft light of evening may make all the difference in the picture.

Indistinct Pictures

There has been much scoffing from time to time at pictures lacking detail, or giving a misty effect. Not a few beginners, however, have ambitions in this direction. Unfortunately, there is no royal and easy road to success. There must be both a fair knowledge of the manipulations of photography and an understanding of what effect is required before the photographer endeavors to obtain it. For pictorial effects are not usually chance ones. As far as the manipulation is concerned, one of the first steps is a very careful adjusting in focusing. By altering the focus and the stops, various parts of the picture may be thrown slightly out of sharp register. Special development for a soft negative is followed by a choice of printing paper. And, either on the negative or during or after printing, hand-work or local control may be practiced. A hand-camera has a good lens, intended to give detail throughout a picture, and it is as well, in the early stages of photography, to be content with this and not hanker after diffusion.

Commencing Work

Let us choose a tree for our first subject, and consider first our lighting. If we examine it with the sun full upon it, we find it evenly lighted and much in one tone. If we look at it from the opposite side, that is, with the tree between us and the sun, we find it evenly dark. From a point at right angles to the sun we find half the tree in light and half in shadow; and as we walk around it we can find predominance in light or shade. There is an old and somewhat discredited rule that pictures should be taken away from the light, that is, with the sun shining on the photographer's back. If this rule is followed we get pictures with an even and flat lighting; that is, everything in sight is about equally lighted, and there are no shadows. A much better rule would be to take the view from a point at right angles to the sun, for then we should get a more even balance of light and shade. Working from this angle as a starting point, we may decide that our picture would look better with less or more shade, and change our position accordingly. The only caution is: do not let the direct sunlight full on any part of the lens itself, or we shall have our pictures spoiled by fog.

Color.

We must be careful not to be too much impressed by the color in our subject. The camera will record only varying depths of gray in the picture, and a rich band of color, without contrast, may give a very flat photograph. Having selected the best viewpoint for our tree, the next thing to decide is how it shall be placed on the plate. If it is a tall tree it will be best on the upright plate, for its greater length is vertical. We have given a rule that the principal object in a picture should not occupy the center of the plate. But if our tree is a fairly balanced one—with equal masses of limbs or leaves on each side—we must not move it to one side of the center unless there is some other object of lesser interest to break this greater space. For here the tree is not the principal object in a scene—it is the scene itself. In practice, with a tall tree, the best way will probably be to photograph it upright in the center of the plate, and trim the edges of the print to give a panel-shaped picture, leaving the tree, but trimming off part of the space on either side. A tree in the foreground often helps a more distant landscape. This is a case where the rule should be followed, and the tree placed toward one side of the picture.

Figures in Landscapes

Very often figures may be included in landscapes—or landscapes used as backgrounds to figures. The simplest rule in regard to this is to have the figures and backgrounds suitable to each other. Thus, in a hay-field, a man or woman dressed in city fashion would look out of place. If we had a number of children romping in the hay, they might be in place, and the picture would then have for its motive the playing children, with the hay-field as a setting. The obvious figures to introduce would be a wagon, with its horses, and a couple of farm men, one loading and the other pitching the hay.

A Few Subjects

There is no lack of suitable subjects. On the banks of a stream we may have a man or a boy fishing; or we may have boys bathing. On a lake we may wait for some boat to pass, or we may see some cattle among the fringing reeds. On a road which requires some object to break its bare stretch, we may get a wagon or a wayfarer, always endeavoring to let the figure fit the setting. Thus, in a trim suburban road between well-kept houses, we might have a neat carriage or automobile, or well-dressed people; but on a real country road, a farmer's team, or a laboring man in overalls, would be more in keeping.

Incoming and outgoing vessels offer pictures of life and sentiment
Walter Burke, F.R.P.S.

Waterfowl appear to best effect when in their natural surroundings

W. H. Wallace

Foreground

We have emphasized the importance of giving sufficient exposure; and we have also pointed out that objects near the camera require longer exposure than distant ones. In nine-tenths of pictures we see a foreground in which we can distinguish specific things and their shadows. If the objects are, say, bushes, there will be lighter and darker parts of them, and these darker parts must be considered. We must expose sufficiently for them and so the distance is over-exposed. But as this over-exposure makes the distance denser in the negative, and therefore lighter in the print, it tends to give a true rendering by making it recede from the foreground.

Sky

The over-exposure becomes more pronounced when we reach the sky, for the negative here becomes so dense as to be unprintable, showing bare white paper where the sky should be. This is a defect, and one which we shall get in most of our negatives. The simplest way of reducing a hard sky is by after-printing. Cover the parts of the paper which have been printed so that the light cannot reach them, and expose the sky until it is slightly greyed. This toning down will tend to add to the brilliancy of the scene in our print. A little more intricate is double printing, when the sky, with clouds, is printed in from a second negative. But these "dodges" scarcely come within our present scope

It is not impossible to obtain clouds and view on the same plate, if one has a little experience in developing. As soon as the clouds begin to appear, wash the negative and paint over the sky part with a brush dipped in restrainer. Replace in the developer, and repeat the operation as often as may be required.

Clouds

It is, of course, possible to photograph clouds, as such, by giving a sufficiently brief exposure. But if we wish clouds as part of a picture, the rest being landscape, we may resort to a color filter. Use an orthochromatic plate to obtain the yellows and greens of the landscape, and a yellow color screen to restrain the intensity of the sky. Just what density of screen to use cannot be definitely laid down, as it will vary with the subject. An eight-times screen is the most widely useful. We frequently see pictures of sea subjects, such as racing yachts, in which the sky looks decidedly stormy. This effect is got by using too dense a screen, and so over-correcting the activity of the sky.

Sunrise

We may photograph the sun itself, but if we point our camera to the midday sky and snap the shutter we shall get a hopelessly fogged plate for our pains. Pictures of the rising or setting sun have been photographed but the result is disappointing, on account of the small size of the image. When we gaze at the rising sun our eyes and attention are focused on it and we take little notice of other objects; but the undiscriminating camera embraces an angle of perhaps 40°, and so the sun appears about the size of a small pin's head. It should have been photographed with a telephoto lens; or, if a picture is made with an ordinary lens, an enlargement of eight or ten diameters of the center of the plate will reproduce more nearly our idea of what the sun should be. In photographing a sunrise we shall get an under-exposed foreground, but this is no disadvantage, as it leaves the sun the point of interest. Try an exposure of $\frac{1}{20}$ of a second, using $f/11$ stop and a slow plate. Two pictures should be taken, one of the sun when only partly above the horizon, and the other when it is clearly risen.

Moonlight

Photographs may be made by the light of the moon, but they are of interest only as curiosities. The best subjects, from a picture-making point of view, are probably open landscapes. Near objects are unsuitable on account of the shadows, for there is little reflected light at night; and, while the parts in direct light are sufficiently illuminated, the shadow parts are simply black. A negative taken by *diffused* moonlight—that is, when clouds cover the moon—will not have the hard shadows, but will give a weak, flat print. On a clear moonlight night, using an $f/8$ stop, an exposure of twenty to twenty-five minutes would probably be sufficient. The moon itself must not be included in the picture, for it travels its own diameter through the sky in about two minutes, and so with the exposure given it will appear as a long ribbon across the plate.

Pseudo-Moonlight Attractive "moonlight" waterscapes are sometimes seen; they are pretty, but they are imitations. They are taken just before or just after sunset, and look best when light clouds show over calm water. If taken before sunset the sun must be behind a cloud and a brief exposure given with a small stop. The large masses of shadow are got by under-exposure or under-development. Where the moon herself appears in such views, she is placed by carefully dropping a blot of ink in the required spot on the negative and letting it dry.

Twilight Photography In towns, or places where there is artificial light, very pleasing pictures of evening effects may be obtained by a combining of natural and artificial light. When the light has so far failed that it is difficult to read a newspaper, a photograph may be taken, using a fairly small stop, in five to ten minutes. If we wish to photograph a house, the lights may be lit and the curtains drawn when the waning daylight is sufficiently strong to render the outside of the house more or less in soft silhouette, and the lights inside show the windows. By drawing light curtains we get a better illumination of the windows than if there is nothing but the clear glass. Views of quiet streets, with the lamps just lit, may be made at this time. People walking do not impress the plate at all for the action is so slow. But if a moving light comes along the street the lens should be covered, or the light will show as a streak along the plate. In pictures of busy streets we often see a clear streak of light running along them. This is caused by the bright headlight of traveling electric cars, though the cars themselves are invisible.

Halation Where bright lights, such as electric lights, appear in a picture, they do not photograph sharp but show as blurred patches of light much larger than they really are. This halation is caused by the light penetrating through the sensitive film and glass support and being reflected from the back of the glass to the film again. This light may be reflected back and forth several times in the thickness of the glass, and every time it reaches the sensitive film it acts on it. We meet halation wherever we photograph a bright object. If we point our camera at a window, the light spreads round the frame and quite blots out the tracery of the window itself; if we photograph a tree against the sky, the branches blur or vanish entirely. In many pictures where we do not suspect it a mild halation is present, and shows itself in a loss of detail, through blurring, in the lighter parts. If we are using films, we are not troubled by halation except in extreme cases. To prevent it in plates the back of the plate is coated with some non-actinic material which helps to absorb the more active rays of light.

Winter Photography

That photography is so often a seasonal hobby is the fault only of the photographer. To the man in search of pictorial effects, the winter is as full of possibilities as the summer; and when our work is with a hand-camera, there is no hardship in the pursuit of pictures under zero conditions. There are pictures to be made when the woods are bare and dark pools stand in the hollows; or when the road is iron-bound in the grip of a black frost. There are pictures then for the beginner, and wonderful pictures for the man with a seeing eye and a knowledge of the possibilities of his camera. But winter at once brings thoughts of snow, and it will be snow that tempts the camera out.

Snow Pictures

When snow first falls we find a thousand wonderful transformations. Form and detail have vanished from familiar things, and we get masses or sweeping lines of white. Probably the most effective pictures for the hand-camera are small details—some bush or tree, or some low building—where we have a contrast of part snow and part object. In the woods we have all sorts of possibilities. A still falling snow may have heaped all the branches, leaving their undersides and the trunks of the trees bare; or a drifting wind may have run a broad band of white up the windward side of every upright trunk. When we stand in the woods after such a fall, we have wonderful choice. Looking against the wind every tree trunk is bare; with the wind each rises as a pillar of white; and as we look across the wind we get the contrast of bark against snow. The great difficulty with snow pictures is to avoid hard whiteness and black shadows; in other words, we must get gradation without too much contrast. Where we have pictures of detail, with contrast, the secret of success lies in giving a sufficient exposure, and developing for softness.

Wet Days

Few pictures are more effective than good, wet day subjects. These pictures are usually taken in towns where the wet streets give reflections, particularly if they are laid with asphalt or other smooth material. There is no reason why country lanes, where the wet gathers in the furrows, should not be equally pictorial, and some fine effects could be obtained with reflections as the skies cleared. But for the moment we are considering wet days with street reflections. If rain is actually falling, the camera and lens should be carefully shielded from it. The metal parts of the camera should be wiped over, both before and after using, with a bit of oiled rag; and the lens should be seen to and wiped from time to time with a soft dry handkerchief, or moisture may condense upon it and so spoil some exposures. With a lens working at *f*/11 we must choose a bright, rather than a dull, wet day, for of course we must have figures in our picture. The reflections tend to shorten the exposure, but, although our prints are low and even in tone, they must not be under-exposed. Unless the light is very bright, do not be tempted by snap-shots, but be content with time exposures. A time exposure is not necessarily a long one, nor does it inevitably demand a tripod. The camera may be rested on a wall or step, or pressed against a post, and an exposure given which will probably be brief enough for anything but actually moving figures. Thus, it is fairly safe to risk that a standing team will not move during an exposure of one second.

Wet Evenings

We have already referred to twilight pictures, and these are peculiarly suited to wet days. Taken when there is daylight sufficient to render detail, but so little that an exposure of minutes is required, the pictures give a real feeling of evening. If the distant lamps have been lit, they will, if old-fashioned gas-lights, show well in the picture; bright lights should be avoided, for they will give balls of halation. It is difficult to give a rule for exposure. We recently rested a small camera on a step. The lens worked at *f*/16 and it pointed down the street westward to a cloudless sky, for the clouds had lifted, though the pavements still gleamed with wet. It was light enough to just read a paper, and we gave five minutes. The negative developed successfully, giving the lights of the feeble gas-lamps, and their reflections, without halation.

Night Pictures

Night pictures are best taken on wet nights. We are dependent on artificial light, and the gleam of pavements is a great help pictorially in preventing heavy foreground shadows. Or snow may relieve the blackness. If we are working by street lights, orthochromatic plates are necessary, and they should be backed to prevent halation. And of course we need a tripod. Pictures should be taken against the light, though very bright lights should not shine directly into the lens. A tree will effectively hide the main light when there is only one, and, silhouetted against it, make an effective object in the picture. An exposure of a minute, with large stop, will give fair rendering of the reflections, but a much longer exposure will be needed to get shadow detail. If halation can be guarded against by masking bright light, try a twenty minutes' exposure.

BOOKS

Hand Camera Photography. By Thomas Kilbey. 121 pp., illustrated. Paper, 50 cents.

The Hand Camera. By Wastell and Bayley. 204 pp., illustrated. Cloth, 50 cents.

How and What to Photograph with Roll Films. By J. A. Hodges. 120 pp., illustrated. Cloth, 50 cents.

Film Photography (THE PHOTO-MINIATURE No. 37). Illustrated. 25 cents.

The Hand Camera (THE PHOTO-MINIATURE No. 76). Illustrated. 25 cents.

Panoramic Photography (THE PHOTO-MINIATURE No. 73). Illustrated. 25 cents.

Pinhole Photography (THE PHOTO-MINIATURE Nos. 27 and 70). 25 cents.

Marine and Surf Photography (THE PHOTO-MINIATURE No. 71). 25 cents.

Street Photography (THE PHOTO-MINIATURE No. 14). Illustrated. 25 cents.

Vacation Photography (THE PHOTO-MINIATURE No. 62). Illustrated. 25 cents.

Outdoor Portraiture (THE PHOTO-MINIATURE No. 58). Illustrated. 25 cents.

Pictorial Principles (THE PHOTO-MINIATURE No. 53). Illustrated. 25 cents.

Art Photography in Short Chapters. By H. P. Robinson. 60 pp., illustrated. Cloth 50 cents.

Letters on Landscape Photography. By H. P. Robinson 66 pp., illustrated. Paper, 50 cents.

Picture Making by Photography. By H. P. Robinson 134 pp., illustrated. Cloth, $1.50.

Selection of Subjects in Pictorial Photography. By W. E Tindall. 83 pp., illustrated. Cloth, $1.75.

The Elements of Pictorial Composition. By F. Dundas Todd. 63 pp., illustrated. Paper, 10 cents.

Pictorial Composition. By A. G. Marshall. 88 pp., illustrated. Paper, 75 cents.

Practical Landscape Photography. By G. T. Harris. 118 pp., illustrated. Canvas, 50 cents.

Practical Pictorial Photography. By A. Horsley Hinton. Cloth, $1.25.

Testing a Focal-Plane Shutter

BY ERNEST A. TURNER

The following method of testing focal-plane shutters is quite simple and the only accurate one I know of, unless special apparatus be used.

The pendulum method is too slow, and the method with a sector on a bicycle wheel does not give correct results. The speed will be given greater than it ought to be, if the sector on the wheel and the shutter curtain are moving over the plate in the same direction, and vice versa. The method suggested is this: Suppose one part of a plate or sheet of paper receives $\frac{1}{100}$ second exposure 100 times and another part receives 1 second exposure 1 time. If developed alike, the tints will be identical. In the same way an exposure of $\frac{1}{500}$ second 500 times will give the same tint.

To use this method for testing a shutter, provide a room with shades drawn. The work must be done by daylight exposure.

The best paper to use is a contrasty development paper and, of course, it should be developed with the proper developers.

Raise the window shade a short distance and place a chair or other article of furniture so it will mark a place in the entering diffused daylight where exposure is to be made. Place a strip of the paper in this light and give it one second's exposure. Develop 20 seconds by watch, rinse and fix. It should be a gray tint (half-tone) if the exposure is right. If too dark or too light, as it nearly always will be, change the position or raise or lower the shade until the proper tint is secured. The slip which is eventually developed to a gray is marked (before exposing) so as to recognize it afterward, as all the slips used must also be marked on the back with a pencil.

Now set the focal-plane shutter at its lowest speed and place another slip of paper behind it, exposing at same position twenty times, if the speed of shutter is $\frac{1}{20}$ second. If the tint is not same as that of the first slip, give a different number of exposures with a fresh strip of paper until a tint is secured which exactly matches the timed slip. Suppose 32 exposures are required. Then the actual speed of the shutter as then adiusted to $\frac{1}{32}$ second, and the Speed Table should be corrected accordingly.

Now, of course, the other (faster) speeds could be tested in the same manner, but if many speeds are to be measured it will be easier to take the lowest speed as another standard and give a slip of paper one exposure at this speed, adjusting the light strong enough so as to develop to half-tone gray. Then work up from this. Usually it will only be necessary to test the speeds with different spring tension and 1 inch or 2 inch opening of shutter. If larger openings are used, these should also be tested, but the smaller openings will work pretty nearly pro rata to width of opening.

A very surprising thing about focal-plane shutters is the small difference in actual exposure made by different spring tensions. In the case of my reflector camera the slowest tension would just barely move the shutter almost noiselessly. The fastest speed (highest tension) made the shutter go like a shot out of a gun, but the actual speed at that tension was only two or three times as great as slowest speed with the same width or opening of curtain.

Notes and Comment

New editions of the following numbers of THE PHOTO-MINIATURE are now ready: No. 9, *Lantern Slides;* No. 58, *Outdoor Portraiture.* The second edition of No. 77: Focal-Plane Photography is now in press and will be ready in a few weeks. The next issue of THE PHOTO-MINIATURE, No. 81, which we hope to publish before the end of July, will deal with some special printing papers, such as Kallitype (fully brought up to date with new formulæ by Mr. James Thomson); A New Sepia Paper, very simply prepared at home; Ozobrome; A Chromate of Silver Paper; Blue-Print Papers, and Oil Printing.

◆

An unusually interesting paper on "Photography and Crime," from the pen of Dr. Geo. G. Rockwood, appeared in the "Evening Post," New York, June 15. Dr. Rockwood's half century in professional photography gives him a wonderful fund of information upon many special branches of photography, and his paper on the usefulness of photography in the detection of crime records some of his experiences.

◆

What is Probus? asks a New England reader. Briefly, Probus is a preservative paint—a something which photographers have looked for and wanted since photography began. When applied to wood, iron, etc. Probus gives an indestructible, protective coating, impervious to water, acids, alkalies, fumes and vapors. Hence, Probus is invaluable to the amateur or professional photographer, to the process worker and a host of others, in fact, to everyone who has to deal with receptacles for chemical solutions, chemical trays, dishes, tanks, baths, dark-room sinks and floors, pipes, etc., For example, wooden or iron trays, given a coat or two of Probus, make the best sort of hypo or washing tanks and are light and easy to handle. We have used a can of Probus with profit and satisfaction and cordially recommend it to our readers as a great convenience and economy in the dark-room. Probus is made by Wolff and Dolan, of San Francisco. The eastern sales agents are George Murphy, Inc., 57 East 9th Street, New York. A pint can of Probus costs 65 cents.

◆

Art Principles in Portrait Photography. By Otto Walter Beck. 244 pages, 48 full-page plates and many diagrams in the text. $3, postage 22 cents extra. For sale by Tennant & Ward, New York.

This book, perhaps the most important contribution to the literature of photographic portraiture yet published, is the outcome of many illustrated lectures delivered by Mr. Beck at photographers' conventions. It was announced two or three years ago and some hundreds of professional workers subscribed $10 apiece to secure copies, but its publication was delayed. Now that it is obtainable for a third the price originally proposed, every portrait worker should possess it and give a portion of each day to its careful perusal. The author deals with his subject clearly and concisely, taking up in turn Composition, the Treatment of Backgrounds, Lighting versus Arrangement, and the Processes involved in treating the negative to obtain particular effects. The photographer who will master the contents of this volume will make more definite progress in the improvement of his portrait work in one year than he could accomplish in ten years' experience without the book. What more can we say?

◆

The Non-Slipping Printing-Frame introduced by Geo. Murphy, Inc., New York, is a novelty on this side of the Atlantic, although widely known and used in Europe. It is a British-made frame, which means well-made, and is fitted with slotted hinges which prevent the back of the frame and the print from slipping when the print is examined. As soon as the merits of this frame are known, it will doubtless supersede all other kinds as a practical economy and convenience in the printing room. The trial size, 4 x 5, costs 38 cents.

⁂

The Hawaiian Photographic Society was formed at Honolulu, H. T., in May, most of the enthusiastic amateurs of that city being present to aid in its formation. A notable work to be undertaken by the society is the securing of photographs of the places of historic interest on the island and placing these in the Hall of Archives as the basis for a photographic survey.

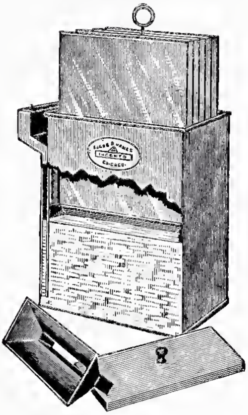
⁂

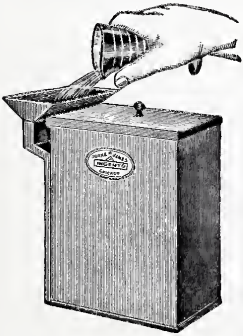
The organizing committee of the International Photographic Exhibition, to be held at Dresden in 1909, report steady progress, with many promises of coöperation from photographic bodies throughout Europe. The interest of American manufacturers is specially invited. The offices of the exhibition are at Dresden-A., Neumarkt 1, Hôtel Stadt Berlin, Germany. All communications to be addressed there.

⁂

Many of our readers will be glad to known that *Wellcome's Photographic Exposure Record and Diary* is now issued in a special edition for the United States with light tables prepared for this country. We know of no other work of its class equal to this pocket volume in practical usefulness and value. Apart from the light tables, classified subject tables, exposure calculator (giving the correct exposure with one turn of the scale), and a mass of useful information about weights and measures, focusing by scale, development, etc., it provides ruled pages for recording negative and positive exposures, thus forming a veritable *vade mecum* for the photographer. The book fits the pocket although it contains 260 pages, and is neatly bound in red cloth with pencil and flap. Price 50 cents, postage 3 cents extra. Trade or single copy orders can be supplied by Tennant & Ward, New York.

The interest in tank development grows apace, and this method, which has common sense as well as efficiency and economy behind it, bids fair to displace all other methods in the amateur's workroom. Even professional workers are turning to it, as witness the demonstration recently given by Mr. E. Goldensky before the Photographic Society of Philadelphia. We hope, before the year is out, to publish a number of THE PHOTO-MINIATURE devoted to the subject, but it is wonderfully simple and really requires little explanation. For those who use roll films, the Kodak Tank is, of course, a complete solution of all difficulties. We have used this steadily since its first introduction, and the results have been so completely satisfying that we regard the Kodak Tank as incapable of further simplification or improvement. For those who use plates, the market offers the Auto Developing Tank, introduced by G. Gennert, New York, and the Ingento Developing Tank, introduced by Burke & James, Chicago. The Ingento Tank is shown in the two cuts accompanying this note, one showing how the plates are placed in the tank, and the other showing the tank closed, and the developer being poured in. This tank has been further improved so that it requires 15 or 20 per cent less solution than formerly, and it can now be had constructed of brass heavily nickel-plated, which permits the tank to be used both for development





and fixing. Full particulars of the Ingento Tank and its use are given in the booklet issued by Burke & James, Chicago, which can be had on request.

⁂

Now that the summer is really with us to stay awhile, there are complaints here and there about stale plates, grilling and similar troubles peculiar to warm weather. The subjoined letter tells of the good qualities of Hammer plates in this regard.

Portland, Oregon.

Hammer Dry Plate Co.,
St. Louis, Missouri.

Gentlemen: Replying to your query regarding the use of your plates in tropical Mexico, I beg to state that on my last trip to that country I took with me ten dozen of your extra-rapid plates 5 x 7. With the exception of four or five plates spoiled by my own carelessness, every exposure I made resulted in a good negative. This is the first time I had had such uniformly good results in many trips and speaks volumes for the qualities of your plates.

(Signed) C. V. Cooper,
Manager Castillca Rubber Plantation Co.

⁂

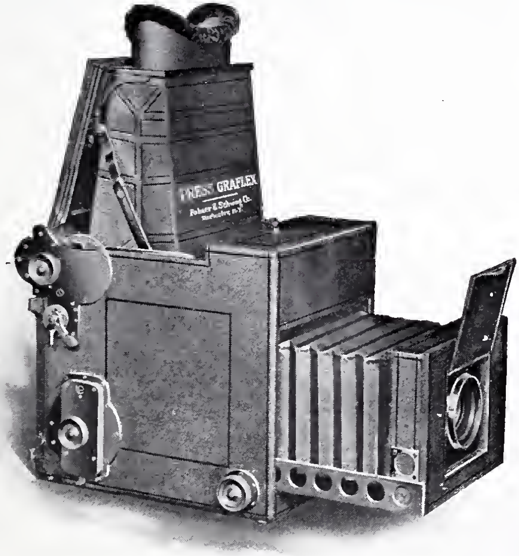
Meyrowitz's "Photographic Bulletin" is a useful little journal edited by Mr. H. M. Bennett and published by E. B. Meyrowitz, 104 East 23d Street, New York, for the helping and convenience of amateur photographers. No. 1, just issued, gives a series of interesting notes on topics of everyday interest, and announces a competition with cash prizes open to all amateurs. We presume that copies of the "Bulletin" may be had on application at any of the Meyrowitz stores in New York, Minneapolis and St. Paul.

⁂

The fifty-second annual exhibition of the Royal Photographic Society will be held at the New Gallery, 121 Regent Street, London, from September 19 to October 20. Intending exhibitors can obtain entry forms from the office of this Magazine as long as the limited supply on hand lasts. Entries must be in London, September 4th.

◆

The Folmer & Schwing Manufacturing Company, Rochester, N. Y., announce a new Graflex camera, known as the Press Graflex, shown in the accompanying illustration. The Press Graflex is made in 5 x 7 size only and is intended for the press photographer. It is of the non-reversible type, but is fitted with two tripod screw plates, so that it can be used in a horizontal or a vertical position, as may be required by the subject. The camera has extension capacity for lenses up to 14 inches focal length, with a minimum of 7 inches, and the special Press Graflex focal plane shutter may be speeded from $\frac{1}{5}$th to $\frac{1}{1500}$th second.



The well known Imperial Orthochrome Light Filters can now be had from G. Gennert, 24 East 13th Street, New York. They come in four sizes, fitting lenses whose flange diameters range between 1 and 2⅛ inches, and in three densities requiring increase of exposure 2, 4 and 8 times.

❧

Despite the wonderful latitude of our plates and films and all the advantages of tank development, correct exposure is still the surest way to success in negative-making. The beginner in outdoor work will find the problem of exposure robbed of its terrors by the intelligent use of a reliable exposure meter. An old favorite with English workers—the Imperial Exposure Meter—is now available in this country, being imported and sold by G. Gennert, 24 East 13th Street, New York. Price 50 cents. We have used this meter and can recommend it with confidence as simple in use and altogether reliable.

❧

"The Moving Picture World" is a new weekly devoted to animated photography, projection pictures, lectures illustrated with lantern-slides, etc. It is edited by Alfred H. Saunders, formerly editor of the "Optical Lantern Journal," and an authority in this special field of work. The subscription price is $2 per year. (The World Photographic Publication Company, 361 Broadway, New York City.)

❧

M. Robert Demachy, whose skill in gum-bichromate printing is well known, has recently exhibited at the rooms of the Royal Photographic Society, London, a collection of fifty prints made by a modified oil-pigment printing method described in a recent number of "Camera Work." The exhibition attracted much attention and seems to have fully sustained M. Demachy's claims in behalf of the possibilities of control offered by this process.

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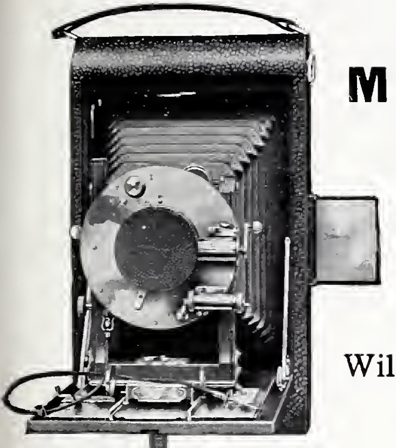

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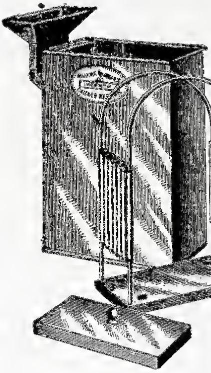

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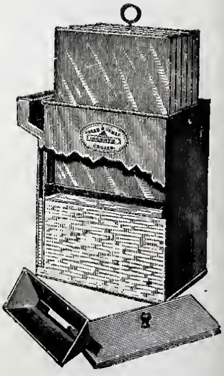

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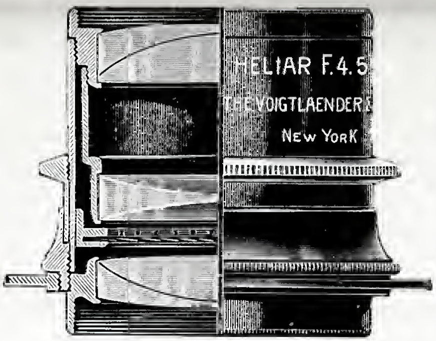

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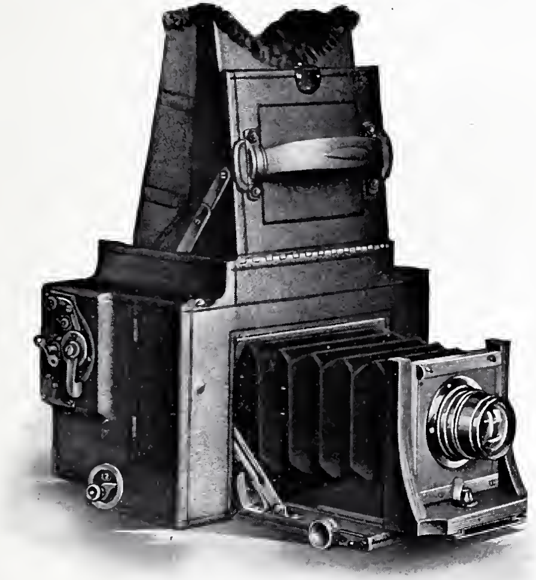

The Graflex idea combined with Film simplicity and convenience make the

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the ideal camera for outdoor photography.

The composition of the picture is seen on the groundglass, right side up, full size of the negative, at the instant of exposure.

The 3A Graflex takes 3A (3 1-4 x 5 1-2) Kodak Film

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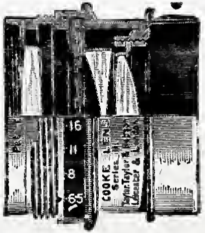
From an untouched negative by Geo. T. Beamish, Waltham, Mass. The cat happened to jump as the shutter was snapped.



Cooke Lenses photograph moving subjects in dull lights. They work quicker than other lenses and their pictures are sharper. Fitted to your Kodak a Cooke lens will make you proud of your photographs. Write for our catalogue with "Helps to Photographers."

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The leading film and plate tester in the country writes:

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The film with the speed of a Seed 27

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PLATINUM PAPER

Develops in hot water alone.

A true platinum paper, especially adapted for landscape negatives. Two grades—smooth and rough.

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Eastman Kodak Company
ROCHESTER, N. Y., *The Kodak City*

MORE THAN CONVENIENCE

The convenience of Eastman Non-Curling, daylight-loading film needs no demonstration. Also, its unsurpassed quality has been fully determined. Yet there still remain two features of Eastman N. C. that have done much to insure the remarkable results so easily obtained by the Kodak system of picture-making. The ability to resist or avoid halation is one.

Halation is simply fog caused by the light rays reflected from the back of the emulsion support. These rays, owing to the angle of reflection, attack the sensitive emulsion at points where they are not wanted and produce a blurring of the image which forms a radiation or halo of light around it—from whence comes the term "halation."

Under many conditions, the ordinary glass dry plate will show this "halation" when N. C. film will be practically free from it.

This is the reason:

The average glass plate is nineteen or twenty times the thickness of the N. C. film, so, naturally, the light rays reflected from the back of a glass plate will increase the amount of halation proportionately over that reflected from the back of the film.

In addition, the film is backed by the dull-surface black paper, which absorbs a very great amount of the light that reaches the back of the film and thus reduces the halation to the minimum degree.

Practically, the only halation evidenced with N. C. film is in cases where the over-exposure in certain parts of the negative is so great that the light is *refracted* by the molecules in the emulsion, to such an extent as to cause a diffusion of light sufficiently strong to affect the sensitive salts.

For these reasons, it is not necessary to manufacture a double-coated or specially backed film to avoid halation.

In addition to its ability to avoid halation is its orthochromatic quality—that is, its ability in a great degree to correctly afford color luminosity value and thus affording the proper tonal gradation in negatives of subjects having a variety of colors, this feature showing to excellent advantage in its ability to retain the clouds in the negative where the extremes of exposure are not excessive.

Eastman N. C. film affords you not only every advantage of the most expensive and best glass dry plates, but also the advantage of lightness, compactness and ability to perform every operation in full daylight.

Eastman Kodak Company

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"A DARKLESS DARK ROOM"

That is what a recent convert to tank development styled the Kodak Tank Developer.

The Kodak Tank Developer is more than that—it is also an errorless dark room. It not only permits you to remain in and work in the freedom of the full daylight, but absolutely prevents the occurrence of any of the mishaps liable to hand-development in the ordinary dark room.

Why should a machine produce better results than those produced by human agency?

The answer is simple and conclusive.

The Kodak Tank Developer was devised for the sole purpose of eliminating the chances of error by the old method, and the principles of its construction are sound from both the scientific and mechanical standpoints. By this method it is not possible to fog the film during development because no light can penetrate to the film. The film cannot be scratched or marred because it is protected by the apron with which it is enclosed. Unskilled judgment as to duration of development cannot lessen the chance of good results, because the time of development has been predetermined by experts.

On every hand and at every step you are protected. If you are inexperienced, the Kodak Tank Developer supplies the experience. If expert, you appreciate the value of the tank and its automatic avoidance of error.

The Kodak Tank Developer is a mechanical dark-room expert, never in the way and always at your service.

OF ANY SIZE

C. H. Claudy, the well-known writer and newspaper photographer, and incidentally a Pocket-Kodak enthusiast, has this to say in a recent number of "*The Camera:*"

"One last word to those who have started photography with a large fund of enthusiasm and a small camera.

"Shortly you will want to make larger pictures. You will want a large camera. Don't get it—get a lantern instead.

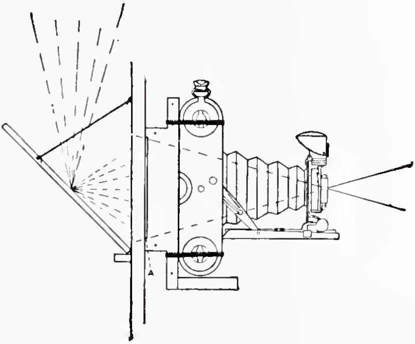
"If your present small instrument is too small for your capacities, in point of lens, shutter and adjustments, by all means get another, but still keep to the small instrument."

Eastman Kodak Company

ROCHESTER, N. Y., *The Kodak City*

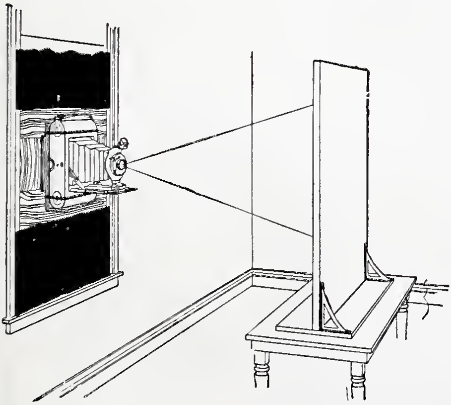
As a matter of fact, you can go Mr. Claudy one better. Instead of getting an enlarging lantern, you may, if you possess a No. 3, 3A, 4 or 4A F. P. K. or Cartridge Kodak, make enlargements of any size with the same little Kodak that snapped the original negative.

The process is exceedingly simple, and all that is required in addition to the Kodak and a simple shelf for holding the Kodak and negative in position, is a room from which the light may be excluded, and with a window through which the light may enter without obstruction from trees or near-by buildings.



Shelf for holding Kodak against window

The diagrams shown herewith illustrate the method of employing the Kodak for enlarging and are taken from our booklet, "Bromide Enlarging with a Kodak," which may be had gratis from any Kodak dealer or by mail from us.

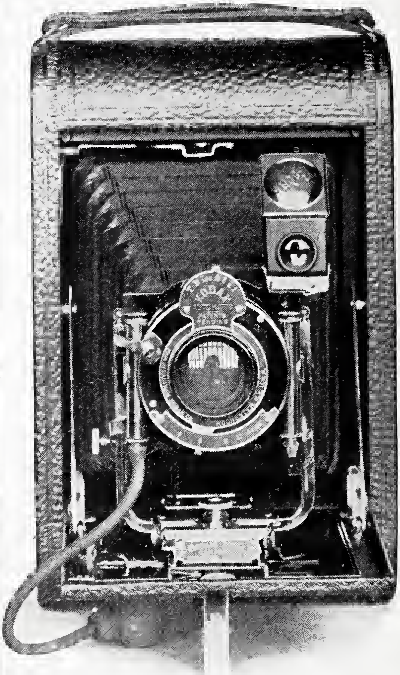


Method of using Kodak for enlarging

Mr. Claudy is right—there is no necessity of burdening yourself with heavy and bulky apparatus and making your outings work instead of play. Instead, just slip a Kodak in your pocket, out of the way until wanted, and upon your return and at your leisure, make your pictures any size you want them with this same little Pocket Kodak. It's *all* easy the Kodak way.

Eastman Kodak Company

ROCHESTER, N. Y., *The Kodak City*



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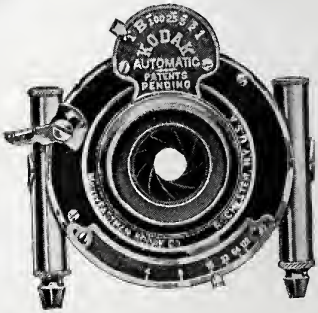

The Kodak automatic shutter is always set, makes automatic exposures from 1-100 of a second to one second. "Bulb" and "time" exposures may also be made. Iris diaphragm stops from Nos. 4 to 128.

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EASTMAN KODAK COMPANY. NEW YORK, *July 6, 1894.*

Gentlemen:—I would like to recall when I first began to use your Bromide Paper—something less than a century ago—since which time I have continued its use. I have demonstrated—

First. The most remarkable uniformity in working. I do not recall the loss of a single sheet of paper from any defect in the paper in the last four or five years.

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Third. Absolute permanency. I have not in many years seen a print change color or fade in the slightest degree, and I do not hesitate to guarantee my customers of the absolute imperishability of the prints. That my own family portraits are on the Eastman Bromide Paper indicates pretty clearly my faith in it. Long may you wave.

Yours very truly,

(Signed) GEO. G. ROCKWOOD.

1902

EASTMAN KODAK COMPANY: *March 6, 1902.*

I now willingly endorse all that I said eight years ago regarding your Bromide Paper—and more.

GEO. G. ROCKWOOD.

1906

EASTMAN KODAK COMPANY: NEW YORK, *January 31, 1906.*

I am making a series of portraits of the famous or representative men contemporaneous with my professional career of the last half-century, for the public libraries of Washington and New York. This series began with the era of William Cullen Bryant, Nathaniel P. Willis, Horace Greeley, Parke Godwin, Bayard Taylor, etc., of the early sixties, through the list of heroes of the war, down to and thus far in the 20th century.

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(Signed) GEO. G. ROCKWOOD.

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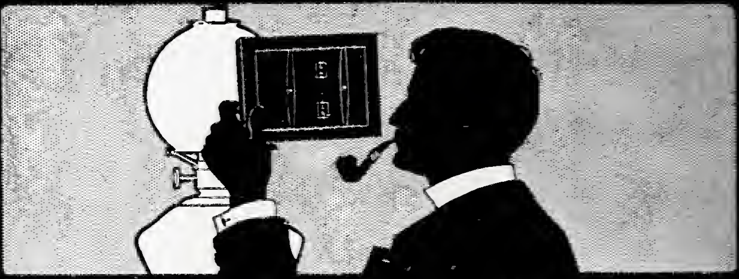

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Possesses features never before incorporated in a camera offered for less than seventy-five dollars.

One turn of the key sets the mirror.

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Makes Time or Instantaneous exposures.

As light and compact as an ordinary box camera.

Write today for catalogue of this epoch-making camera

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has speed, brilliance and definition, a range that the amateur needs for outdoor work.

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in every

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Emulsion is clean, dries quickly, with firm, even surface. Negatives are crisp, brilliant, full of detail, and possess the **printing quality that holds up through toning and fixing.** Under artificial light (flash or electric) Hammer Plates far excel any plate in the market in Rapidity and Chemical Effect. Send for Hammer's Little Book on Negative Making—it's free on request; then

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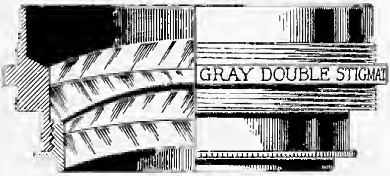
If your dealer can't supply recent emulsions promptly, we will put you in touch with one who can.

HAMMER DRY PLATE COMPANY
SAINT LOUIS MISSOURI

Let us mail you our (free) 1907

STIGMAT BOOKLET



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WIDE-ANGLE STIGMATS

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This latest production of Carl Zeiss embodies all the characteristics of the Tessar *f*/6.3 together with greater speed, the largest apertures being *f*/3.5 and *f*/4.5. It is, therefore, most suitable for cinematograph work, portraiture, ultra-rapid, instantaneous and focal-plane-shutter photography.

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SEVEN PORTRAITS OF CHILDREN

BY R. DÜHRKOOP

We have unusual pleasure in offering to our readers in this issue seven reproductions from a collection of portraits recently received from Herr R. Dührkoop, of Hamburg. Although comparatively unknown outside of his own country until a few years ago, Herr Dührkoop occupies today a unique position in his profession and is, without doubt, one of the most skilled of living portraitists. His work, superb in its technical as well as in its pictorial qualities, has been medalled wherever exhibited :— in all the principal cities of Germany, Great Britain, Italy, Spain, and this country, and that at exhibitions where it was placed in direct comparison with the work of prominent leaders in photography.

A special exhibition wholly devoted to the work of Herr Dührkoop was held a few months ago in London and excited so much attention there that the collection was afterwards sent on tour among the principal cities of Britain. The collection sent us was submitted for use in the *American Annual of Photography*, wherein a generous portion of the collection will be published, but we could not resist the opportunity to show in THE PHOTO - MINIATURE these charming examples of child portraiture.

R. Dührkoop, Hamburg

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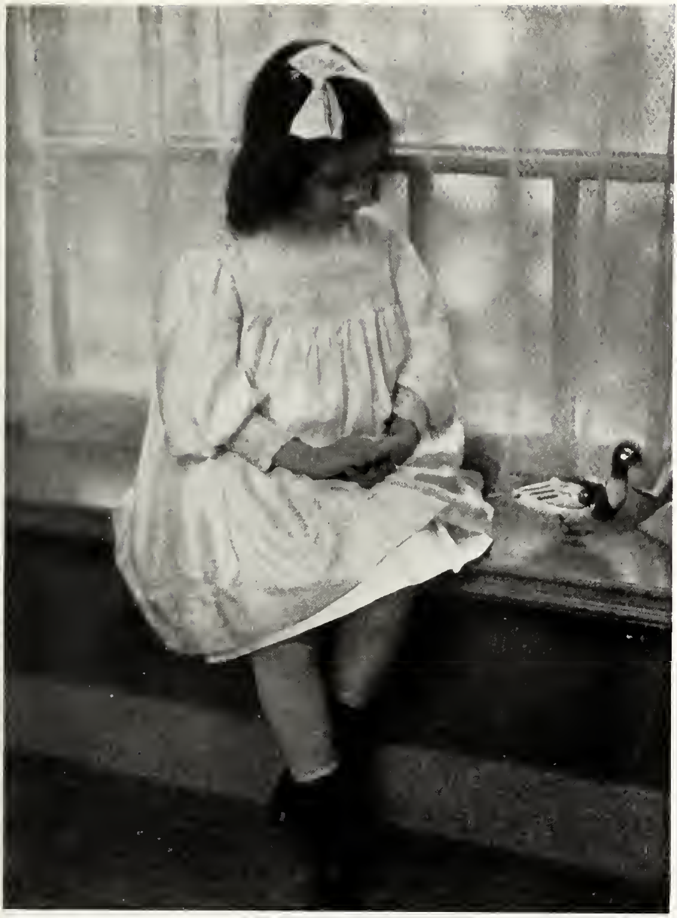

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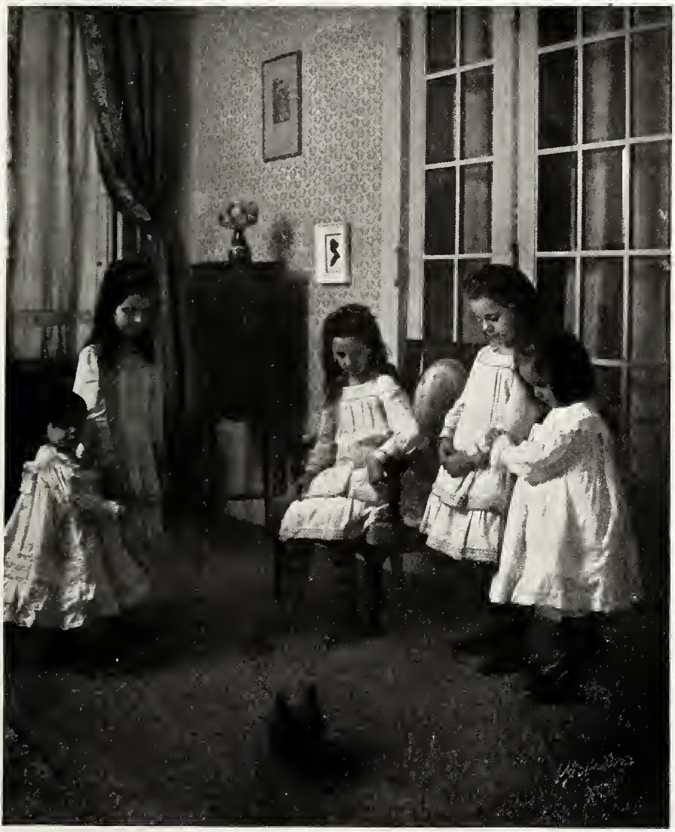

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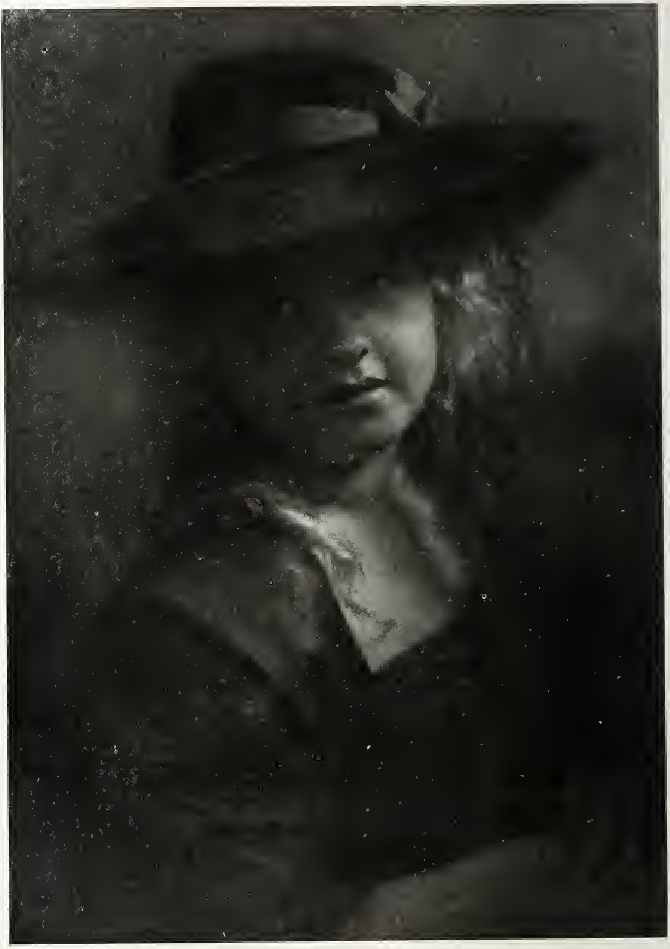

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The Photo-Miniature
A Magazine of Photographic Information
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Volume VII SEPTEMBER, 1907 Number 81

Kallitype to Date

SUPPLEMENTING THE INFORMATION GIVEN IN THE PHOTO-MINIATURE NOS. 47 AND 69

BY JAMES THOMSON

In THE PHOTO-MINIATURE No. 69, was given an account of my mode of working kallitype in black and white, a method that for cheapness and celerity of operation is far ahead of any other with which I am acquainted. I have no fault to find with other modes of working, some of which I have tried and found satisfactory. For prints in black, however, I consider the process I have worked out to be the least involved, the operations being limited to simple development, fixing, washing and drying. A brief outline of this process may here be in order.

A suitable paper is coated with iron salts, is dried and printed under a negative, resulting in a well-defined provisional image. This faint image is then developed in an acid silver bath, when immediately we get a vigorous image in blue-black,—more or less pronounced as we may elect to have it by modification of the sensitizing medium. The print is washed for a minute, then fixed in weak hypo for another five minutes, and then washed for half an hour and dried. Simple and cheap, yet the results are good, while the image on a well-sized, soft-working, pure linen paper cannot be distinguished from the more costly platinum.

In the issue of THE PHOTO-MINIATURE mentioned was given a formula that, in my personal employment of it, has stood the test of time. I some years ago devised it for my own special use, but, finding it so good, it seemed to me a pity to withhold its benefits from others, my own demands being limited. So much as an excuse for submitting it to the craft.

Having, however, done considerable by way of experiment since the process was first given out, I now desire to make such correction and addition as is deemed necessary to insure best results.

I do not purpose going over the ground exploited in a previous number. For such additional information as is required, I would refer readers to the issue in question, No. 69, where all such details as to paper to use and coating are to be found. I, however, here repeat the first formula there quoted, which now will be found corrected to date, making good results more certain.

Formula No. 1, for black tones.—Distilled water, 1 ounce; ferric oxalate (Merck's or Mallinckrodt's), 15 grains; citrate of iron and ammonia (brown scales), 25 grains; chloride of copper, 8 grains; oxalate of potassium, 35 grains; oxalic acid, 15 grains; silver nitrate, 15 grains; gum arabic, 10 grains.

Mix in the order given in a wide-mouthed dark bottle. Without agitation more than turning upside down once or twice, set aside for twelve hours. Stir up from the bottom, then shake well. Filter through absorbent cotton. Placing a wad of cotton in a glass funnel, pour in the contents of the bottle, sediment and all. Take the wad up between the fingers and thumb, and squeeze all the liquid back, the gritty particles alone remaining in the discarded wad of cotton. The bottle should be rinsed clear of sediment before the filtered solution is once more placed in it. The solution is now ready for use, and will keep in good condition, when well corked, for a year at least. The formula is given in ounce quantities to answer requirements of workers having small negatives, say 4 x 5. Simply multiply quantity in accordance with needs.

Coating may be done either with a flat brush or a celluloid flexible pad, as suggested in THE PHOTO-

MINIATURE No. 47. If the pad is used, it should be in conjunction with *white* velvet, which excels all other fabrics for even coating. It costs a dollar a yard; a quarter of a yard lasting some time, as it can be washed and thus used over and over again.

A heavy sheet of glass is a good ground on which to coat. It may be raised at the upper end, thus insuring a downward flow of solution. Clasp the paper at the four corners by attachment of clips, such as are used by men to hold four-in-hand ties in place,—small metallic clasps of bulldog grip.

In coating, pour sensitizer on the upper portion of sheet, and, as quickly as possible, go all over the surface. The idea is to get the entire surface well coated and wet as soon as possible, so that drying will be equal. An even, thin coating is essential, as pools of solution simply mean spots that print darker than balance of surface. When surface-dry, complete by artificial heat.

Print until all but the whites are tinted, though time is governed to some degree by the paper employed. On heavily sized and rough paper we may be obliged to take from the frame before the half-tones are visible. When printing is completed, develop the faintly defined tawny image in the silver solution, which should be made up as follows:

Distilled water, 1 ounce; silver nitrate, 40 grains; citric acid, 10 grains; oxalic acid, 10 grains. When all dissolved, decant, or filter through a piece of fine linen, there being a milky precipitate we want to get rid of. Another way is to add the oxalic acid just before developing, when the milky condition of the bath will not matter. In every event we require about a grain of the acid to each dram of solution. This is a stock solution, and to develop 4 x 5 prints we measure out two drams, and add water to make two fluid ounces. Use a porcelain tray. Immerse print, face down, immediately turning over to break any bubbles, which, if present, will cause white spots in the finished print. The image immediately flashes up, but the print should remain, say, a minute, so that blackening will be even. In order to get black tones, a sized paper must be used. Too thin a coating, which may be the case where sizing is insufficient, means scraggy brownish prints, the image lacking depth.

After development, wash away the silver, then immerse in a weak hypo bath for five minutes, water, 32 ounces; hypo, 50 grains. Prints on rough paper may remain in this bath for ten minutes. Some papers will not stand long immersion; in such cases, if the paper be thin,—say Japan tissue,—two minutes' fixing will be enough. In any event, when the whites in the finished print are at all dingy, it is indicative of insufficient fixing. In such a case, expose until half-tones are visible, then fix well. After fixing, wash for at least half an hour. The image in the foregoing formula is, as a rule, blue-black, though with some papers it may have a brownish tone, due no doubt to the manufacturer's sizing of the stock. Size with arrowroot for good black tones.

The following formula gives beautiful pure blacks the equal of any platinotype on the market. As compounded, on average negatives it is likely to give strong contrasts, and is therefore just the thing for thin overtimed negatives. If we consider the solution as submitted to be of maximum strength, we may dilute it to answer our needs without any impairment in the quality of the resultant image. The ounce may, with safety, be diluted to one and a quarter or one and a half. In my own practice, I measure out a half-ounce into another bottle, and add the necessary water. I then take a proof print, and, if necessary, add a little more water. Contrast may always be had by the addition of from one to ten drops bichromate of potass. solution made in the proportion of ten grains to the ounce of water.

Formula No. 3 for Black Tones.—Distilled water, 2 ounces; citrate of iron and ammonia (brown scales), 68 grains; ferric oxalate, 30 grains; oxalate of potass., 68 grains; chloride of copper, 16 grains; oxalic acid, 30 grains; silver nitrate, 30 grains; citric acid, 4 grains; bichromate solution, 5 drops; gum arabic, 10 grains.

The formulæ here given have been carefully worked out, and the balance is extremely delicate. A small addition of copper may tend to blue, while a very small additional quantity of silver will tend to greenish blacks and more contrast. An addition of silver, then, means greenish or brownish blacks, and contrast, while a very small additional quantity of the copper will cause blue tones, finer grain but flatness. Over ten grains of copper to the ounce means a spoiled solution, which no further addition of iron will remedy. When confronted with rustiness of the shadows we may suspect an overplus of silver. We may restore the balance by adding a very trifling quantity of copper. Measure out a mere trace of the copper on the blade of a pen-knife.

The following formula should be excellent in showing up detail on a well-sized smooth-surface paper:

Formula No. 4 for Black Tones.—Distilled water, 1$\frac{1}{8}$ ounces; citrate of iron and ammonia (brown scales), 21 grains; ferric oxalate, 25 grains; oxalate of potass., 36 grains; oxalic acid, 16 grains; chloride of copper, 8 grains; gum arabic, 10 grains; bichromate solution, 5 drops. If too intense, simply dilute. For contrast, add bichromate.

I have here submitted formulæ to suit most negatives. No one solution can be given that will answer for all negatives or all qualities of paper stock. Moreover, a difference in strength of sizing with which paper may be coated results in variation in contrast, even with the same solution. The worker must simply prepare a solution to suit his negatives and the paper he uses. Uniformity in method will tend to uniform results. Once a solution is found suited to a particular paper, it is foolish to flit from one make or brand to another.

Now a word in regard to the ferric oxalate, on which more than anything else success depends. When bought of the dealer it should appear in glistening greenish brown scales, the condition being quite observable through the amber-colored bottle in which it is contained. When inclined to be powdery, matted together or clinging to the sides of the bottle, it should be rejected as worthless for the purpose. Once the bottle has been opened it is apt to quickly spoil unless we take precautions to prevent this. Immediately discard the thin shaved stopper that comes in the bottle. Substitute a good long cork which has been soaked in hot wax or paraffine. In addition, keep the bottle inside of an air-tight screw-top jar such as is employed by housekeepers for preserving purposes. In this way ferric oxalate will keep in good order until the last few grains are used.

While due care is always essential whatever the process, there seems in this to be not the remotest reason for carrying on operations in artificial light. All necessary manipulations, including the coating of the paper, may with perfect safety be carried on in an ordinary room and in subdued daylight.

It is always well to make a test print from the solution before coating a lot of paper. It is better not to attempt to print in damp weather, it being then somewhat difficult to gage progress. When faded prints begin to show up, discard the developer and replace with fresh. Two ounces of dilute developer containing ten grains of silver will develop two dozen 5 x 7 prints. Keep developing tray clean by occasionally washing with muriatic acid. Wash brush after coating and keep away from dust. Double-coat on smooth papers rather than use a strong solution whereby detail in the shadows will be obscured.

Slightly over-printed pictures may be reserved for toning with uranium. Very beautiful effects are thereby easily possible, the process on kallitype prints having a reducing action; therefore, prints but little over-exposed are just right for toning. By this process of toning the most brilliant purples, browns and reds are possible, also innumerable variations in sepia. Red chalk effects are particularly beautiful when the picture is vignetted and a broad expanse of pure white margin is possible. Heads are well adapted for this mode of treatment. Coat the center of a sheet of paper in a careless manner with a wad of cotton. Development may be also with a wad of cotton, the resultant picture afterwards being toned to a red chalk color in uranium solution. This bath is as follows: Uranium nitrate, 5 grains; red prussiate, 5 grains; glacial acetic acid, about 20 drops; distilled water, from 2 to 3 ounces. The dry print should be immersed in this, the tray during operations being rocked. Prints that have been thoroughly dried tone best. Many fine tones are easily possible by simply varying the proportions. Brilliant reds in a normal bath will be reached in about five minutes. Simply immersing for about a minute and taking out again will give warmth to the blacks, at the same time acting as a reducer.

Toning completed, in running water swab prints back and front with a wad of absorbent cotton. While others are toning, we may place prints in a tray of clear water to which a few drops of acetic acid have been added. Complete by washing in running water for ten minutes, drying on cheese-cloth or clean papers. In both this process and platinum toned with uranium, minute green spots are apt to develop. When print is first immersed in the bath, if the face of it is swabbed with a wad of wet absorbent cotton, I am certain the spots may be avoided. To my mind, almost imperceptible air-bubbles are the cause of the spots, which, if attended to at the start, will free us from this objectionable feature. Once these green spots are present, they must be painted out to match body of print.

In conclusion, I would remark that while the process here outlined is most simple, like others of the same kind there is always present the element of uncertainty. As a rule all is plain sailing, but the quality of the chemicals is all-important,more particularly the ferric oxalate. The high cost of platinum makes necessary a looking around for something to take the place of processes demanding its use.

While kallitype cannot claim the lasting qualities of platinotype, it is at least in that respect the equal of any other silver process. Moreover, in no other known process is resemblance to its higher-cost neighbor so great, the rich deposit of metallic particles being identical,—in the one case the metal platinum, in the other silver, the color and general appearance leaving us in a quandary to differentiate. Metallic platinum is now quoted at something like twenty-six dollars an ounce. Silver can be bought for half a dollar an ounce, and I have the word of eminent American workers that they are getting results with this kallitype process that good judges have mistaken for high-cost platinotype. Here the cost does not much exceed the blue print, and one has the choice of the rarest papers to print upon, including Japan tissue.

A New Sepia Paper

GIVING RICH BROWN TONES BY WATER DEVELOPMENT

BY JAMES THOMSON

As is well known to advanced workers, the much-admired warm tones in platinotype are due to the presence of mercury either in the sensitizing medium or in the developing agent. My first endeavors to introduce mercury in a water-tone iron-silver process were not crowned with success, the purity of the whites leaving much to be desired. Subsequent experiments, however, disclosed a method whereby the difficulty could be overcome, and a series of trial prints now on record give evidence of the fact that a new and very beautiful mode of photographic sun-printing has been added to the list.

Specimen prints submitted to the Editor of this publication brought forth the following expression of opinion: "This new paper is exceedingly interesting and should be very popular if it will give results like these prints in the hands of the average man and from the average negative."

The prints referred to were made in the ordinary course of experimentation, wherein no special pains were taken either to select the quality of paper stock best suited, or to properly size the surface, which in most processes is all-important. There need, therefore, be no uneasiness lest others find a difficulty in at least duplicating such results.

A suitable paper is the main thing, and that employed successfully in the ferro-prussiate process may be depended upon to give good results in the present case. Soft porous stock should not be used, there being always a difficulty in clearing the whites. In experimenting, good-quality linen writing-papers were successfully used, among which were heavy bond, Marcus Ward's pure flax, Old Berkshire Mills, Bunker Hill linen, etc., all having a good sizing as bought, but none the worse for another coating of arrowroot.

The color obtained is dependent not only on quality of paper, the sizing with which it has been originally coated at the mills, etc., but also on whether it be rough or smooth, hard in texture or porous. Thus—the same strength of sensitizer will give light browns on smooth bond papers, while or heavily sized or rough stocks much darker browns will result. Nor will all papers answer in this process; in some the sizing is at fault.

Mercurio Sepia Paper for Warm Brown Tones.—Salting solution: Distilled water, 2 ounces; citrate of iron and ammonia (green scales), 32 grains; ferric oxalate, 40 grains; oxalate of potass., 40 grains; oxalic acid, 8 grains; bichloride of mercury (crystals), 8 grains; gum arabic, 20 grains. Use a dark bottle, and dissolve the above for at least twelve hours. The resultant solution, as a rule, does not require filtering.

With a flat camel's-hair brush, a flexible celluloid pad covered with white velvet or wad of absorbent cotton, apply a thin, even coating. When surface-dry, complete by artificial heat, thus retaining solution on the surface. Any attempt to force the drying with heat before becoming surface-dry results in inequality of sensitiveness. Once drying has been effected, apply the sensitizer in the same manner, drying precisely as before. Sensitizer is as follows: Distilled water, 2 ounces; silver nitrate, 100 grains; citric acid, 70 grains; tartaric acid, 20 grains. Filter carefully.

We may use the same pad for both coatings. Placing the sheet of paper on an inclined board or sheet of glass, a small pool of solution may be poured on the upper portion and quickly and evenly spread. As rough papers absorb liquid more than do smooth, it is necessary to dilute salting solution, also where sizing is heavy. Overmuch contrast simply operates to bury shadow detail. No one solution will suit for all negatives nor for use with all papers. A test alone will determine the necessary strength, as negatives vary so much in opacity.

The color of the print varies with the paper employed, the tones sometimes tending to a reddish brown. As a rule, however, on close-textured, rather hard-bodied sized papers, there result beautiful browns and golden half-tones, the like of which is not to be found in any silver paper at present on the market. On a heavy bond paper watermarked "Alexis," colors were obtained similar to Eickemeyer's picture called "The Dance," as published in *American Pictorial Photography.*

In regard to the printing: As a rule, we should take from the frame when the half-tones are just beginning to show, the high lights remaining untinted. We must take from the frame before wholly printed out, the water bringing out finer detail.

Wash as in the blue-print method,—say, for from two to five minutes, according as paper be smooth or rough; then fix for ten minutes in the following bath: Water, six ounces; hypo, 12 grains; common salt, 36 grains. Shorter time in fixing tends to yellowish browns, longer time, reddish browns. Fixation completed, wash in running water for at least half an hour.

When there is a good amount of pure white in a composition, which it is desirable to preserve in the print quite untinted, it is a good plan to take from the frame when somewhat under-exposed,—that is to say, before the half-tones are at all visible. Wet the face of the print and, while holding it in the hand, allow development to proceed to the required point, then finish by washing as usual.

On the other hand, a print that is slightly over-exposed may be saved by quickly washing away the unaffected salts. This can be done most effectually by holding the print under the tap, letting the water run over the face of it with some force.

To weigh out the hypo and salt each time when one is printing, would, in the end, prove somewhat bothersome. In this exigency, a wooden mustard-spoon may save us the trouble. Such spoons may be bought of the kitchen furnisher at a cost of two for five cents. While they vary in capacity, they may be easily whittled down to the size required with a pocket-knife. Fill up the spoon and level off contents even with the top. Then carefully weigh the amount, hypo or salt, it matters not which. Even after knowing how much a spoon contains, it is an easy matter to measure out, say, three ounces of water, a spoonful of hypo, and three of salt, the spoon I use holding precisely six grains of either chemical.

Modifications by way of variation in quantities and additions are numerous, and result in some beautiful colors. It is a wide field, and the end is not yet. Space will not, however, permit of my giving more than the original formula at this time. The process is one that should appeal to advanced workers.

While solutions may be combined and the coating effected by a single application, the first salting and afterwards sensitizing results in richest and most vigorous pictures. When less vigor will answer, or with a rough or very heavily sized smooth paper, coating may be done with the combined solutions. With average negatives, however, the most satisfactory results will be had on a paper not too heavily sized, when there will be a wonderful transparency in the shadows. Nothing in the negative will escape.

Choose the paper that best answers the purpose. For light tones something after the order of the heavy bond or a glossy writing-paper may suit. As a rule, the more porous or rough the paper, and the heavier the sizing, the deeper will be the color. Further, paper coated with a wad of cotton will have less body of solution than when pad or brush is used.

Prints dry much darker than appearance in a wet state would indicate; due allowance should be made therefor. Prints also should be washed and fixed very shortly after being taken from the frame, for the reason that once this paper has been exposed under a negative, even though we remove it from the frame, and keep it in the dark, printing action will, up to a certain point, continue.

In the deeper shadows sometimes there will develop a disagreeable gloss which, viewed in certain light, detracts from the appearance of the picture. It is not due to solarization, but is entirely owing to the reduction of metallic particles, being greatest in the deepest shadows, thus causing a "shininess," which does not extend to other portions of the print. To eliminate this objectionable feature, and at the same time impart to the print a velvety effect, thereby improving it greatly, we have but to swab the surface with dilute photo-mounter. Dilute Higgins' photo-mounter to about the consistency of cream, and, with a wad of absorbent cotton, go over the face of the print. This is a valuable wrinkle, as black kallitype prints are also very much improved in appearance when an application is made of the mounter thinned down.

The Blue Print Process

The gentle reader whose file of THE PHOTO-MINIATURE includes No. 10 will hardly expect to find much of novelty in this paper, for the blue print process reached finality long ago as far as any important improvement is concerned, and there is little that is new to tell about it. But it is all new to the man who has not yet tried it; it is still the simplest of photographic printing processes; and, despite the innumerable host of new papers introduced year after year, blue print paper is more largely sold and used than any other photographic paper in the market. This, of course, is chiefly due to its usefulness in the building and engineering industries for the reproduction of drawings, plans, sketches, designs, etc. We are told, for instance, that not less than 11,000 square feet of blue print paper are used in the building of a single battleship!

But all this is outside the little photographic field with which we are familiar. Among amateur and professional photographers the use of blue print paper is limited because of the characteristic color of the print:—an "atrocious" blue says one, a "perfectly lovely" blue says another,—in technical terminology, "Turnbull's Blue."

Trial Prints: Negative Registers

Because of the extreme simplicity of the process, blue print paper is most generally used by amateurs for the making of trial prints—a graphic demonstration of the possibilities of the negative for printing processes in general. In making such prints it is well to use a piece of paper about half an inch longer than the negative, this half-inch strip being shielded from light action during the exposure, so that after development the print has a white strip along one edge, convenient for purposes of record. Such prints may be bound together in lots of fifty or a hundred to form a useful register of one's negatives—one of the indispensable things we are forever going to make, but rarely have the courage to begin!

Other Uses Another use for blue print paper is the making of occasional prints when photographing away from home, on vacation, etc., the blue print post card being the most convenient form for this purpose. Then there are some subjects, as we may learn from the famous Delft ware and certain carbon prints in Braun's and Hanfstaengel's collections, which may be made pleasing to the eye if carefully printed on blue print paper and tastefully surrounded by just the right shade of gray, or a well proportioned frame of dull warm brown wood or mat ebony. Again, with subjects lending themselves to poster treatment, and the right qualities in the negative, blue print paper lends itself acceptably to decorative purposes in prints of fairly large size. In educational work, also, the blue print has a large field of usefulness, from the reproduction of complicated diagrams for class use to teaching the young idea how light affects the things about us, working continuous change with its magic touch. Nor must we overlook the little things required in quantities for home use at times, where simplicity and economy of production are to be considered, such as the making of menus, illustrated programmes for children's entertainments, book-markers, book-plates, decorative covers for manuscript music and the like. For these and many other similar purposes the blue print process offers peculiar advantages.

Commercial Papers Blue print papers, post cards and cloth can be bought, ready for use, at many photographic and artists' supply stores, and is inexpensive, so that for all who live in large towns or who can readily buy by mail, and so be sure of obtaining fresh paper commercially, it is really cheaper to buy the paper ready for use than to prepare it for one's self. Freshly prepared paper is necessary because, once sensitized, it rapidly deteriorates and will not give clean, bright prints. For this reason the better class of commercial papers, put up for sale in sealed cans or tubes, are preferable to the cheaper varieties which are sold in loose sheets or from the roll. Three commercial papers which I can safely recommend are French Satin Jr., Ideal and Eastman's Blue Print paper; similarly Eastman Blue Print Post Cards and the fabric known as Silkdown are reliable products.

Materials

Since, however, the home preparation of blue print paper is very simple, and may be desirable in many circumstances, the necessary formulæ and manipulation are given: Materials required: A few ounces each of ferric ammonium citrate (ammonia-citrate of iron), and potassium ferricyanide (red prussiate of potash); powdered arrowroot; two or three small, soft sponges or Blanchard brushes; a stoneware or dark orange or green glass bottle of about 10 ounces capacity; two porcelain or agate-ware trays; and a supply of any good hard-sized paper. Of these, only the first two are absolutely essential with water. There are two varieties of ferric ammonium citrate. That most commonly used in the past and called for in most printed formulæ is the ordinary variety everywhere obtainable in brown scales. The other variety (green scales) is less common, but is advised in later formulæ as giving a more rapid (sensitive) paper, and better prints. It is manufactured by Merck (New York) and, I believe, by Mallinckrodt (St. Louis), but will have to be specifically ordered in most cases where supplies are purchased through small supply houses. In purchasing potassium ferricyanide, be careful to get the *red* (not the more common yellow) prussiate.

The arrowroot is sometimes needed for sizing the papers. Some workers add a little glucose. Good, hard-sized papers do not require any sizing before sensitizing; but, wherever the prints are dull and sunken in appearance, this may be taken as indicating that the paper should be sized before use.

Choice of Papers

Blue prints may be made on any kind of paper, provided it is sufficiently sized, but the better the paper the better the print. Good, hard-sized linen or bond paper is always suitable and readily obtained. The photographic papers Rives and Saxe are perhaps those most desirable for general use, but Rives paper is not easily procured in this country. Crane's bond papers are always reliable. Cartridge, Johannot and Whatman papers offer other varieties for special purposes, and I have seen charming blue prints, with soft, lustrous images, made on Chinese rice papers as well as carefully chosen Japan papers and tissues; but these require considerable skill and dexterity in handling because of their fragility.

Sizing the Paper

To size any paper make up the following sizing solution or mixture: Take powdered arrowroot, 180 grains; glucose, 40 grains, and mix them in a little cold water to form a creamy mass. Add 20 ounces of hot water, boil in a porcelain or agate pan with constant stirring and set aside to cool. Later, the tough skin which forms is removed and the mixture is strained through canvas, when it is ready for use. Now fasten a number of sheets of paper, cut to convenient size, to a board slightly smaller than the paper. Taking up a small quantity of the sizing on a soft sponge, spread it evenly over the paper, brushing the mixture first up and down and then across the sheet. Then with a second (clean) sponge, lightly efface all brush marks or streaks, and hang the sized sheet to dry in a warm, well ventilated room or closet. Thin papers can be sized by immersion in the sizing solution.

Brown's Formula

Blue print sensitizing formulæ are innumerable. I give first place to a simple formula by George E. Brown, which calls for the new *green* ferric ammonium citrate. A. Dissolve 110 grains ferric ammonium citrate (green) in 1 ounce of water. B. Dissolve 40 grains of potassium ferricyanide in 1 ounce of water. These two solutions are made up separately in any desired quantity with the proportions here given. They are then mixed together and kept in a stoneware bottle, but the single solution should always be filtered before use. The mixture will retain its good qualities for months if kept from the light.

The following are old, reliable formulæ and call for the brown-scale variety of ferric salt:

Millen's Formula

Potassium ferricyanide, 1 ounce; ammio-citrate of iron, 1 ½ ounces; distilled water, 10 ounces. Mix thoroughly and filter. The solution should have a deep wine-color and dry on the paper a lemon-yellow. If the solution is green and has a precipitate, the ammonio-citrate is old and spoiled, or you have been given plain citrate of iron. The mixture should be kept from the light by placing the bottle in a light tight tin or similar container.

Nicol's Formula

A. Ammonio-citrate of iron, 3 ounces; water, 4 ounces. B. Potassium ferricyanide, 2¼ ounces; water, 4 ounces. Just before using mix together one part each of A and B and add two parts of water.

Commercial Powders

Ready-prepared blue-print powders, which need only to be dissolved in a given quantity of water before use, can be bought at the stores. Of these my experience recommends Cyanine, E. W. N. and Montauk powders. These are extremely convenient when traveling with a camera and involve only a trifling expenditure.

Sensitizing

Sensitizing the paper should be done in weak daylight or any artificial light of not too great intensity, the sensitizer being applied to the paper exactly as described for sizing, but with a sponge or brush or wad of cotton used exclusively for this purpose. Coat the sheet in successive strips with a brush not too dry or too fully charged with solution. Do not coat too quickly or too slowly; the brush should be passed over a twelve-inch sheet as quickly as you can count ten, saying the words deliberately. After coating the sheet with strips up and down, take a slightly drier sponge or brush and pass across the sheet from side to side, to ensure an even coating free from streakiness. After the sensitizing is completed, the paper should be dried as quickly as possible and then stored in a tin or other receptacle away from light or damp until used. Home-sensitized paper will not keep more than a day or two. The addition of half a grain potassium bichromate to each ounce of sensitized solution (or boracic acid) is said to give better keeping qualities to the paper and greater sensitiveness, and I think it does, though the gain in sensitiveness is not marked.

Negatives Clean, crisp negatives, well developed with fairly vigorous contrasts give the best blue prints. During exposure in the printing-frame the paper gradually changes from its bluish green or orange-green to bluish gray and a dull olive-green, the shadows having a gray-bronzed, choked-up appearance. The printing should not be hurried; most beginners do not print sufficiently deep: a little over-printing can be remedied by prolonging the washing or developing.

Developing Development is effected by simply placing the print in cold water so that the whole surface of the print is wetted immediately, and changing the water occasionally until all the details are seen to stand out clearly defined and with good gradation. After changing the water two or three times, let the print remain face down for ten or fifteen minutes to thoroughly clear away the iron salts from the texture of the paper. To insure brilliant prints, development should not be done in very strong light, as this tends to veil the finer details. Water containing alkalies, such as lime, chalk, etc., also tends to degrade the brilliancy of the blue print. This should be remedied by adding citric acid (20 grains to each pint of water) to the wash water. A single rinse in plain water at the last will remove all traces of the acid from the print. Over-long washing, especially in slightly alkaline waters, reduces the strength and brilliancy of the print. A properly exposed and developed blue print is always more brilliant when it is dry than it appears when in the wash water.

Ozobrome

Ozobrome, the invention of Mr. Thomas Manly, of Ozotype fame, is most simply described as a modification of the well known carbon process, the Ozobrome print being a true pigment or carbon print produced by chemical action instead of the direct action of light as in the ordinary carbon process. The new method is exceedingly simple in manipulation and has already become very popular abroad, despite the fact that it was introduced only nine months ago. As the patent rights for America have been acquired by the Eastman Kodak Company, the materials required for its use will doubtless be placed on the market at an early date. In the following notes we reproduce the working instructions issued by Mr. Thomas Manly, revised from his later advices, together with the experience of an American worker, Mr. G. Hamner Croughton.

Compared for a moment with other pigment printing processes with which we are familiar, Ozobrome offers the following peculiar advantages: (1) the worker is independent of daylight for printing; (2) no sensitizing or exposure of tissue is required; (3) the sensitive material is bromide paper; (4) carbon enlargements can be made directly from enlarged bromide prints, thus saving the trouble and expense of making enlarged negatives; (5) pigmented pictures can be made either upon the original bromide paper or transferred to any suitable surface; (6) the prints being non-reversed, double transfer is unnecessary, and the method is therefore particularly adapted for making prints on opal, ivory, etc.; (7) several copies in carbon may be made from one bromide print without using a negative, and the original bromide print may still be retained unaltered; (8) any kind of negative may be used for printing, as the different grades of bromide and gaslight papers now procurable enable the worker to get soft or vigorous effects at will.

Materials Required A bromide print, a piece of pigment plaster, patent pigmenting solution, and, for Method No. 2, a piece of Ozobrome transfer paper. Both bromide and gaslight prints are suitable. Ozobrome pigment plasters are alone suitable, ordinary carbon tissues not being adapted for the process.

Every trace of hypo must have been thoroughly removed from the bromide print. To harden the gelatine surface, soak the print in a 10 per cent solution of formalin for five minutes, wash for about ten minutes and dry. Of course, the print may be dried and kept any time after hardening.

The manipulations are as follows: Three porcelain dishes or trays are placed side by side, thus—

Tray A	Tray B	Tray C
Working Pigmenting Solution	half-full of cold water	half-full of cold water

Into tray A is poured the working pigmenting solution, viz.: the concentrated solution as sold, diluted with four times its bulk of water. Trays B and C are next half filled with clean cold water.

Take the bromide print and immerse it in the dish of cold water C, face upward, and remove any air-bells by lightly rubbing the surface with a soft sponge. Take the pigment plaster, cut a little larger than the bromide print, immerse it in the same tray C and rub the surface with the sponge, but be careful not to allow it to remain in the water for more than thirty or forty seconds.

Take the plaster from Tray C and, after allowing the superfluous water to drain from a corner, transfer it, film upward, to Tray A containing the pigmenting solution and push it under the surface with a soft camel hair brush, then rock the tray to insure an even soaking of the film. Allow the plaster to remain in the pigmenting solution for one and one-half to two minutes (the longer time for dense, black bromides).

Now remove the soaked plaster and, after draining off the superfluous solution from a corner, draw it face downward along the surface of the water in Tray B and, in bringing it out, drag the gelatinous film across the edge of the tray to remove any air-bells.

Now transfer the soaked plaster to Tray C in which the bromide print is immersed, and very gently place it, film side down, upon the surface of the water, first touching the water with one edge only and then lowering the remainder of the plaster so as to drive forward any air-bells; then take hold of the underlying bromide print and lift the two papers in close contact with each other out of the water. Shift them at once into position and squeegee them into close contact upon a sheet of plate glass. (It is advisable that the thinner of the two papers should be uppermost when squeegeeing.) Then either hang the adhering papers up, or place them upon blotting paper until ready for development. (The operation of bringing the saturated plaster into contact with the print under the water should be done as quickly as possible, say four or five seconds, otherwise some of the pigmenting solution contained in the gelatine film will be lost by diffusion in the water.) The water should be changed after each print has been manipulated. Leave the bromide print with its adhering plaster for fifteen to twenty minutes. At the expiration of the specified time, there are two methods which can be adopted to produce pigmented pictures.

Method I This is the non-transfer process, in which the bromide print itself is made to form the support of the picture, and is recommended for artistic work on the various grades of rough bromide paper on the market. The prints by this method may be more easily worked upon with a brush than those by *Method II*.

MANIPULATION FOR METHOD I

Immerse the adhering papers in hot water at about 105° or 107° Fahr. Feel at the corners whether the papers are likely to separate easily. If so, remove the paper backing of the pigment plaster with a steady, unbroken pull, leaving the print in the water and throwing away the plaster backing. After a minute or two place the print upon a sheet of zinc and remove all the soluble gelatine by gently dashing or laving the warm water over the print with the hand until development is completed. Then wash the print in cold water for a few minutes. Should any of the black silver deposit remain under the gelatine in the very deep shadows, it may be easily removed by the Howard Farmer Reducer, after which wash for fifteen minutes. The Farmer Reducer practically removes the silver image under the gelatine image. It is made up in two solutions as follows: A. Dissolve one ounce of hypo in ten ounces of water. B. Dissolve one-half ounce potassium ferri-cyanide in five ounces of water. Place the print in A and add sufficient of B to color the solution a pale yellow.

Method II

In this transfer process the image, impressed upon the plaster by contact with the bromide print, is transferred to another support, leaving the original bromide print available for further transfers, the resulting print being a pure carbon picture on plain paper without any silver substratum. The method is just as simple as Method No. 1, though it takes longer to describe the operations.

MANIPULATION FOR METHOD II

To carry out Method II, a piece of Ozobrome transfer paper is placed in Tray C, the back and front rubbed with a soft sponge and left to soak for about one minute.

Instead of placing the adhering papers in hot water, they are placed in Tray B, and, after a few seconds, soaking, the papers can be easily separated by a steady pull from a corner. In this case, the pigmented gelatine of the plaster will adhere to its own support, leaving the bromide print uncovered and changed from black to light brown color. As the bromide print may be redeveloped and used again, it is well to leave it in Tray B, holding the plaster in your hand. The plaster now represents the exposed tissue in ordinary carbon printing, with the immense advantage that the image is reversed as regards right and left, thus securing an unreversed picture by single transfer, with the further advantage of choice in the character of the support.

Transferring

Place the plaster upon the surface of the water in Tray C where the transfer paper is already immersed, gelatine side upward. After about thirty seconds, bring the underlying transfer paper into contact with the pigment plaster and lift the two papers clinging together out of the water, place them on a sheet of zinc or glass, and squeegee them into contact, exactly as in carbon printing. Place between blotting-paper under slight pressure, and, after ten to fifteen minutes, develop as in *Method I.*

To redevelop bromide prints that have been used for the transfer process: After separation from the pigment plaster the bleached bromide print left in Tray B should be washed in cold water for fifteen to twenty minutes, after which it will be ready for redevelopment. Place the thoroughly washed print in a porcelain dish and pour over it a bromide developing solution, such as amidol, hydroquinone, etc., then again wash thoroughly for half an hour. The bromide print is now restored to its original condition and efficiency, and can be used again for transfer printing. In fact, with care, as many carbon prints can be made from one bromide print as the strength and substance of the original bromide paper will allow.

OZOBROME AS A BASIS FOR FINISHED WORK

Mr. Croughton's Experience

When I first read the published descriptions of the Ozobrome method of making carbon prints, I thought I saw in it great possibilities as a method for expeditiously obtaining a permanent (carbon) print upon the various bases, such as paper, porcelain, ivory, etc., which an artist uses who produces worked or finished prints for photographers. With this idea, I sent to England for the necessary materials and have just finished a series of experiments with the process

My first experiments were disappointing. The directions said that either bromide or gaslight papers could be used, and, having some gaslight prints handy, I tried the process with them, but could not get an image either with Method I or Method II. The prints bleached all right, but the pigment was not rendered insoluble and it washed away leaving the support perfectly clean. I then tried bromide paper prints and succeeded at once. The explanation may be that in England gaslight papers are slow bromide papers, while on this side they are either pure chloride papers or chloro-bromide. At any rate, success was simple and certain with the bromide prints; so simple in fact that any one can be sure of success with ordinary care and attention in following the instructions.

Method No. I, in which the Ozobrome print is developed directly on the bromide print, has many interesting possibilities which I shall not dwell upon here. For my special purpose—the obtaining of permanent prints upon various bases for after-finishing in black and white, sepia, water-colors and oils—I used Method No. II. After the plaster had rested in contact with the bromide print for about twenty minutes, it was placed in cold water for a minute and then I stripped the plaster without any difficulty, leaving the bromide print unaffected. I had previously cleaned a piece of ground opal and placed it in a dish of clean cold water. Taking the plaster, I at once brought it into contact with the opal under water and, drawing them from the dish together, I squeegeed them together just as in the carbon process. After they had rested under slight pressure for ten minutes, the opal with its adhering plaster was placed in a dish of water at about 95° Fahr., the paper stripped off and warm water gently laved over the gelatinous coating until the picture was completely developed upon the opal support—an exact facsimile of the original bromide print, the color of the pigment plaster being engraving black in this case.

The advantages of this method over the usual expensive bromide opal process giving prints of doubtful permanency are obvious. With Ozobrome, the enlargement can be made on bromide paper (and if it is a vignette it need not be made the full size of the opal), and by the simple method outlined one can obtain a carbon print on the opal support in any desired color and of indisputable permanency. If more than one finished print is required, the single bromide enlargement will serve for as many prints as may be wanted, re-development in an ordinary metol-hydro developer restoring it to its original strength and usefulness.

I have, of course, used the carbon process in obtaining such prints on opal and other supports in my work, but the Ozobrome method is much simpler and saves the labor and expense of the enlarged negative, which often had to be reversed, thus necessitating the use of the troublesome double-transfer process. Altogether, I am confident that Ozobrome is a decided addition to the printing methods already available, that it further simplifies the practice of photography, and that it has a big field of usefulness before it when its possibilities are further developed.

News and Comment

Beginning with this issue, THE PHOTO-MINIATURE will hereafter be dated with the month in which it is actually published, the serial order of the publication being preserved as in the past by numbering the issues in consecutive order. Thus, this issue is numbered 81 as properly following No. 80, but dated September—the month of actual publication. Present subscribers will be individually advised of the change this will make in their records of subscription, and future subscriptions will be recorded as from one specified number to another instead of from one month to another.

This does not mean that we have abandoned in any measure our determination to issue the magazine regularly on time month by month, but simply obviates the confusion which has arisen from the irregular dating of the magazine due to its irregularity of publication. Just as soon as we find it possible to issue the magazine regularly month by month (and in spite of many difficulties we are confident that this will be accomplished), the plan here proposed will naturally result in the magazine appearing, like every other properly conducted periodical, with serial number and date following each preceding issue in normal order.

❧

The sensation of the past few weeks has been the announcement, by the editor of *Photography*, Mr. R. Child Bayley, that photography in colors is, in very truth, an accomplished fact. Mr. Bayley's announcement is backed up by the relation of his personal experience with the new process, together with the equally successful experiences of Mr. Eduard Steichen and Mr. Alfred Stieglitz, of this city. Apparently, the first results were shown in June at the Photo Club of Paris, since which time Mr. Steichen has worked continually with the method, obtaining results which completely satisfied his critical eye in the matter of fidelity of color reproduction. The method is extremely simple, consisting wholly in carefully following the instructions and formulæ issued with the plates, which are manufactured by Messrs. Lumière, of Lyons, France, to whom the credit of the working out of the process is due. By a single exposure and development, followed by reversal and redevelopment, these plates give positives in colors accurately reproducing the colors of the object photographed, just as one would see in a perfectly colored transparency or lantern slide. It all sounds fantastically unreal, but there seems to be no room for reasonable doubt that the problem which has puzzled photographers since Daguerre's day has at last been solved. The only difficulty experienced has been the impossibility of supplying the demand for the special Autochrome plates. We hear from the agent for the Lumière Company in this city that a specimen of the new process has been received and that the plates will possibly be obtainable in this country about the end of September. Meanwhile we republish on other pages the experiences of the editor of *Photography*, as given in that journal.

⁂

Widespread curiosity has been aroused by the remarkable examples of pictorial group and figure work by Mr. F. Benedict Herzog, published in *Camera Work*, the *Century* and other magazines. Some of these compositions include as many as twenty figures, showing groups and single figures skillfully combined by a certain amount of handwork to form decorative panels for friezes, etc. In the August *Cosmopolitan* Mr. Herzog describes his methods in an interesting way, accompanying his article with a detail from the frieze "Men Kiss and Ride Away."

⁂

An interesting experiment, which bids fair to be an assured success, is modestly announced in the advertisement of the United Photo-Materials Company, of Boston. This company is coöperative, its capital stock being, for the most part, owned by photographers who use its products, these being supplied to stockholders at a considerable discount from the list prices. The products of the company are sold for cash only, and direct to the customer, this plan assuring a practical economy in the handling of the business for the benefit of its stockholders. The company is under the management of Mr. C. O. Loveil, formerly manufacturer of the Lovell plates and photographic specialties, who may be addressed at the office of the company, 48 Summer Street, Boston.

⁂

During the summer we spent our holidays, a few days at a time, in an earthly Paradise made up of sand-dunes and sea, a tidal river and miles of pine and cedar, refreshing winds and glorious skies. The combination seemed unusually favorable to a practical test of the new Ingento Color Filter recently introduced by Burke & James, of Chicago. This is a carefully calculated color screen made according to the formula and methods prescribed by Mr. R. James Wallace, Photo-physicist at the Yerkes Observatory. It slips easily over the hood of the lens, and, with an exposure eight times normal on an orthochromatic plate or film, it is said to give a true rendering of the visual luminosity of subjects, including color. Of course our work with it was wholly of the average hand-camera sort, with nothing scientific about it. But this much must be said, the use of the Ingento Filter gave us a lot of thoroughly good negatives, yielding peculiarly satisfactory prints on platinum paper. Almost all the subjects included either delicate contrasts such as cloud-flecked skies and sunlit dunes, or heavy contrasts such as evening skies, river and shores lined with dark green cedars. We recommend the Ingento Filter as a decidedly good thing.

⁂

Every one at all interested in the world of wonder and beauty revealed by the lens, whether in photography, microscopy, astronomy or every-day life, will enjoy *The Prism*, a dainty little magazine published by the Bausch

& Lomb Optical Company, of Rochester, N. Y. Its articles are cleverly written and convey a lot of useful information in an attractive way. Copies may be had by writing the publishers and mentioning this magazine.

❧

Writing of lenses reminds us that a statement made on page 354 of THE PHOTO-MINIATURE No. 79 needs correction. In writing there of cemented vs. uncemented lenses, we asserted that we could find no real superiority demonstrated for one type as against the other. In this we overlooked the obvious fact that a lens composed of many glasses cemented together will pass less light in a given time than a lens composed of a smaller number of glasses and whose elements are uncemented. This loss of light-passing capacity in any cemented lens, as compared with an uncemented lens, increases with the age of the lens and amount of use, simply because the balsam used in cementing lenses discolors slowly but surely, tending to slow the lens by forming a faint yellow-gray screen which retards the passage of light. This discoloration is plainly apparent if the lenses to be compared are placed together on a sheet of clean white paper. If we place a Cooke anastigmat (composed of three simple uncemented lenses) alongside other (cemented) lenses in such a comparison, it will at once be perceived that the paper under the Cooke is absolutely unchanged in whiteness and purity (proving that no light is lost in passing through the objective), whereas there will be seen to be a varying amount of discoloration in the white paper under the other lenses, according to the number of cemented surfaces in each lens, the quality of the cement used, and the age of the lens.

Color Photography

BY R. CHILD BAYLEY, in "Photography"

The "discovery of photography in natural colors" is boomed in some quarters or another almost every week. "Wolf! wolf!" has been cried so frequently, that I should not be greatly surprised if a number of my readers pass the announcement we make this week with some such phrase as "Oh! the old story."

Yes. It is the old story, down to its very details, but with the difference that what has hitherto appeared as a theoretical possibility is actually a practical commercial fact.

"What is that?" says the reader.

Just this. That it is now possible, or it was last week, to go into a shop in Paris, and to purchase a special form of dry plate, which, exposed much as any other plate is exposed in the camera, gives within half an hour of exposure a finished and dry positive transparency on glass, in all the colors of nature, as true as the best three-color work I have ever seen—far and away better than most.

There is no difficulty about the process whatever. It calls for no skill or knowledge that is not the common property of every photographer. There is no balancing of one screen against another, no dyeing or washing out, no triple exposures and triple treatment of any kind, no registration or want of it, not even any waiting. It is a simpler and a far easier process to produce a perfect color photograph on these plates, than it is to make an ordinary negative and to print it in P. O. P.

Nor is there any imperfect color rendering to be apologized for. One or two shades are not quite right, but as a whole the colors are true; certainly there is none of that general weakness of some one color one often sees in three-color work.

An expert knows that the severest test of three-color photography is to get a white and a black. Many a process, which will deal fairly well with colored subjects, breaks down completely when tested by its power of dealing with white, black, and grey, giving them with a marked tint. This does not. In the midst of the most brilliant colors faithfully rendered, black, white, and grey come out without the faintest tinge.

The results are positive transparencies on glass with a fine grain, so fine that they can be used very satisfactorily as lantern slides; but people with good sight can detect the grain without a magnifier, while with a magnifier it is very distinct. There is, up to the present, no way of reproducing these pictures on paper; but they can, of course, be used as originals from which three-color illustrations can be made in the customary manner. They can be viewed from either side.

Nor are these "inventors' claims," but a matter of my own personal knowledge. My results have not been obtained on samples sent me by the makers for trial. I wish they had, for the new plates, half-plate size, cost about half-a-crown apiece, and I had to buy them in the ordinary way. Nor is there any secret, mark, as to the general outlines of their production. The makers give all the necessary formulæ, so that those who will can make up the solutions for themselves, while those who like to save themselves the trouble can buy them ready made. They are just ordinary developers and things, without anything not readily purchasable.

The new plates are called "the Autochrome plates." They are the invention of Messrs. Lumière, of Lyons, and have been on sale in Paris for some weeks. I say "on sale;" perhaps I ought to have said "they have been sold," for the demand has so outrun the supply that they can only be got now and then, and in small quantities. So great has been the interest they have aroused there that none have yet made their appearance in the English market. But the factory in which they are made is rapidly extending its capacity, and before long, no doubt, they will be obtainable in any quantity through the recognized channels. My own supplies were obtained from the shop of M. Henri Calmels, of 150 Boulevard Montparnasse, Paris. In 13 x 18 centimeter size (a trifle larger than 7 x 5 inches) they sell at ten francs a box of four. In addition to the plates a yellow screen is used on the lens, and a few chemicals are required. The yellow screen must be that which the makers supply; no other will do.

Later on I will say something about the theory of the process. Let me first deal with the manipulations. I will suppose the plates, chemicals, etc., have come to hand, and the impatient amateur wishes to make his first color photograph. First of all, then, he turns his focusing screen round so that the ground side of the glass is away from the lens, This is done because the plates are exposed through their glass, or from the back, so we must allow for the different distance in focusing, and turning the glass does this near enough.

Then we load the slide, having first made a carrier to take the French size plate, if we have not got one already. As the plate is turned glass side to the lens, we must be most careful not to injure its very sensitive surface with the spring of the dark slide, so with each box of plates we find we have given to us a set of cards of the same size, with one side of each blackened After putting the plate in the slide, one of these cards is laid down on the top of it, black side next the plate, and then the dark slide is fastened up in the ordinary way. As the plates are sensitive to red light, as they must be to reproduce red colors, the slides must be filled in the dark, or at least in a position where no direct light from the lamp can reach them. This I did by turning the lamp to face the wall, so that there was just a very feeble light in the room, but nothing more. I may say there was no trace of fog on any of my results.

All is now ready for exposure. Although the emulsion is extremely sensitive to light, the plates need a comparatively lengthy exposure; that is to say, a very little light will fog them, but a good deal is needed, reaching them in the legitimate way, through the glass, to give the picture in its natural colors. The makers say that in good bright sunshine a landscape, with f/8, requires one second exposure. Six seconds are needed if the weather is cloudy. Few people are likely to expose their first plates on landscape subjects, but will select rather a group of flowers or some other still life, readily attainable, and the problem of exposure is to be faced. It is all the more serious because it is the only problem in the whole process. Everything else is quite automatic, and could be done almost, if not quite, as well by a machine as by a man.

I arrived at the exposure by the aid of the invaluable Watkins meter, of course. I harked back from Messrs. Lumière's instructions. In good diffused light we are told that the plates require about six seconds at f/8. Now six seconds is about the time the meter paper takes to darken in good diffused summer light, from which it is clear that they must have a Watkins speed of about 2. This means that with f/11 the correct exposure is about twice as long as it takes the Watkins meter paper to darken.

Accordingly, having set up a still-life subject indoors, I put the meter down beside it, and found the paper in the meter darkened in four minutes. Using f/11 for my first exposure, then, I gave eight minutes. The result was a tribute to the accuracy of my deduction and to the usefulness of the meter. It was as correctly exposed a plate as could possibly be wished.

The development was next put in hand. Never since I developed my first plate, twenty-three years ago, did I feel the interest and impatience that filled me as I carried that slide into the dark-room. For the reader must remember that I had seen specimens of what the process would do in skilful hands, and wondered how far I dare hope to be able to do likewise.

The developer is the old-fashioned pyro-ammonia, and a liberal supply has to be used, for there can be no stooping over the dish in the red light to see if the plate is covered. It must be covered and developed in the dark. The Stanley clock, which forms a prominent feature of my dark-room, is put where the light of the red lamp falls on it; there is no need to take the temperature of the solution, for sufficient reasons.

The developer is poured on, the dish covered with a card, and rocked for two minutes and a half. As soon as that time is up, the developer is poured off, and the plate held under the tap for fifteen seconds, put back in the dish, and covered with a solution of potassium permanganate and sulphuric acid. I will not go into details of the composition of the baths, as I simply followed the makers' formulæ, as they give them. Let it suffice to say the acidified permanganate (Namias's reducer, in fact) is poured over the negative, and as soon as that happens —less than three minutes, all told, after beginning the development — the plate, unfixed, may be carried out into broad daylight, and everything else done in the fullest light. In less than half a minute, on holding up the plate, the colors will be seen to make their appearance; and in a couple of minutes the permanganate has done its work, and the plate is no longer a negative, but a positive, in true colors, though the colors are not so brilliant as they will be at the finish. It is again rinsed for fifteen seconds, and an ordinary amidol developer poured on, in daylight. This darkens the creamy-looking surface of the film, and when it has acted for two minutes it is poured off again. Another fifteen-seconds rinse is followed by a quarter of a minute or less in the permanganate reducer, but this time it must be very dilute. Another rinse, and we pour on a silver intensifier, which is allowed to act for half a minute or more. This brightens up the colors, and as soon as it has acted sufficiently it is poured off, and a fairly strong plain solution of permanganate is applied for half a minute. This is followed by a rinse, which in its turn is followed by two minutes in acid-hypo, then the plate has five minutes washing under the tap, and is finished. It dries in ten minutes or a quarter of an hour, without the aid of heat, and may be varnished or protected with a cover glass, like a lantern slide.

Now, although if that list of operations is read over quickly it seems elaborate, they take less time to perform than it has taken me to write a sketch of them. The sensitive film is so thin that each solution speedily acts right through it; hence the fixing is complete in two, the washing in five, and the drying in fifteen minutes. Here, too, let me point out the absence of difficulty of any shape or kind. Except the silver intensification, there is no one stage which calls for any determination by the help of the eye. The development is done by the watch, and all the other operations by time also.

Anybody who can pour liquid over a plate and can tell the time by a watch can carry them out as efficiently as Messrs. Lumière could do themselves. As for the intensification, that is done until either the colors are bright enough, which can easily be seen, or the solution becomes muddy, in which case it must be poured off, and fresh must be used.

But I do not want, here, to rewrite instructions, but to narrate how I myself got on with my own attempts. Let me say that my first plate was as good as any three-color photograph, produced in any method, by the most skilful three-color experts that I have ever seen. And it was my first—using a strange, unfamiliar plate, a developer I have not used for years, and working with nothing more than the makers' printed instructions, with the recollection of an interview a day or two before with my friend Mr. Steichen (which is reported in *Photography*, July 16.—Ed. P.-M.).

My second plate was a portrait. Now for portraiture with comparatively slow plates, a good light and a rapid lens are almost essentials. I had no studio available and no portrait lens, so I had to do the best I could with an *f*/6 Stigmatic and an ordinary London room, light being the light of London in (alleged) summer. A lady model was good enough to sit unmoved for three minutes (*f*/8 being used), the time of exposure being the time it took to darken the meter paper. The result was equally good. The flesh tones were flesh, the color of the eyes distinct and unmistakable, and the shadows in the white blouse free from the slightest trace of any greenish tint so often seen in three-color work in such conditions. A bunch of roses, a blue-black velvet focusing cloth, and other details, were equally well rendered. With a studio in a good light, and a portrait lens, the exposure should not be longer than from fifteen to thirty seconds. Other plates were exposed on other subjects, but need not be specifically described. Let me add merely that the plates worked "like clockwork," and there was not one which, treated exactly as the makers laid down, did not give perfect rendering.

The theoretical basis of the process must not be passed by, although it has all been published years ago in *Photography*. It is only our old friend the three-color process in a new guise; only, instead of interposing screens, getting three negatives, making positives, and superposing in registration, all is lumped into one. The glass is first coated with some tacky adhesive, on which is spread a layer of transparent grains of starch. These grains are all of a size. They are of three kinds, however—one dyed an intense violet, one a vivid green, and one a brilliant orange. The dyed starch grains are thoroughly mixed in such proportions that, when dusted over the plate, the colored light passed by them, being combined by the eye, as the grains are very small, looks perfectly white, and without any trace of color whatever. The interstices between the starch grains are then filled up, in some way not described, with black particles—carbon in some form—so that no light whatever can pass through the plate, except through the dyed starch grains. So that, although every particle of light passing through such a plate is vividly colored by the starch, yet on holding it up to the light the plate only looks much like a piece of finely ground glass, without perceptible color. It says wonders for the able way in which this most ingenious process has not only been devised, but carried out, that this blending, easy in theory, is accomplished in practice.

I believe that at this stage the plate is subjected to pressure to consolidate its coating, but this is a detail of manufacture which has not been published. At any rate the starch-coated plate, with or without some protective varnish, is then used as the basis for a coating of some panchromatic or red sensitive emulsion, similar to that used on the red-sensitive variety of orthochromatic plates; but this layer, as already mentioned, is kept extremely thin. Such is the "Autochrome" plate.

As no emulsion is so perfectly orthochromatic that it can be used without any color screen at all, a yellow light filter, adjusted to these plates, is supplied for use with them. It is fairly intense in color, and is of the ordinary kind in tint, very much like the "ten times screens" on the market, but deeper.

When a negative is made by exposing an Autochrome plate with its glass side to the lens, the light after passing through the glass has to pass through the dyed starch grains before it reaches the sensitive film, and these starch grains act as the color screen. Let us suppose we have a colored object, and for simplicity's sake we will assume that it is violet in color—the exact shade, in fact, of the violet-dyed starch particles. The violet light passes unaltered through the starch that is dyed violet, but is stopped completely by the green and orange particles.* After developing them, under each violet particle, in the part of the plate representing the violet object, there is a little particle of black image, while under each green and orange particle, no light getting to the sensitive emulsion, nothing develops. When the acidified permanganate is applied, this reducer dissolves away the black particle of silver under the violet starch grain, but has no action on the unaltered silver bromide under the green and orange starch grains, which, therefore, remain, not opaque, but partially opaque. On holding the plate up to the light at this stage, therefore, and looking through it, the light comes through the violet starch grain uninterruptedly, but the green and orange grains are partly hidden by the undeveloped, creamy colored, silver bromide. The result is that the film in that part looks violet — the color of the original. When the plate is immersed in the amidol developer, in daylight, this darkens the silver bromide, and makes it more opaque, and so the colors are brightened up. When we further intensify the picture with silver, we darken the silver bromide grains (which are no longer bromide, but metallic silver), and so still further brighten the colors. Finally, if there is any unaltered bromide left in the film, this is removed by the hypo, which acts as a kind of guarantee that the final image is silver, and silver only.

Such is the process in outline. It is impossible at this stage to foretell what will be its results. That it is revolutionary is unquestioned, yet, paradoxically enough, it is not novel. Messrs. Lumière published the details years ago, and they were faithfully recorded in *Photography*, but, to tell the truth, the photographic world looked upon it much as it looked upon the Lippmann results—as the outcome of a beautiful laboratory experiment, and nothing more. Messrs. Lumière have shown that it is very much more. That it is a practical, commercial, simple process. Just as the Kodak Company advertise " the skill is in the tank," so may Messrs. Lumière say " the skill is in the plates." They have done the experimenting and the thinking, they have done the balancing of violet against green and green against orange, the orthochromatism, the dyeing, and the registration. The customer buys the product of their inventive genius and their great technical knowledge, he uses it with his ordinary photographic knowledge—nothing more whatsoever.

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* The action is not quite so simple as we are describing it to be, but this may be taken as being true in outline.— R. C. B.

And the results. Well, they must be seen to be believed. I did not believe in them until I saw them. And I can hardly believe in them now that I have made them myself.

Books and Prints

All books noticed in these pages may be ordered from the publishers of THE PHOTO-MINIATURE and will be promptly forwarded postpaid to any address on receipt of the publishers' prices as here given.

The Complete Photographer. By R. Child Bayley. 410 pp., with over 100 illustrations. New York: McClure, Phillips & Co. Net $3.50. Postage 17 cents. (London: Methuen & Co.)

It was to be expected that, if the editor of *Photography* put his practiced hand to the making of a book about photography, the outcome would be a work of unusual merit. The handsome volume before us amply meets our expectations and, with due regard to the excellent text-books by Brothers, Abney, Chapman Jones and others, is undoubtedly the most satisfactory handbook to photographic practice at present available in the English language.

The distinctive note of the book is its clearness of explanation combined with brevity of expression—the two qualities most desirable in works of this class. The three chapters dealing with "The Lens in Principle," "The Selection of a Lens" and "The Lens in Use" are luminous examples of the author's success in his method. In the chapters on "Orthochromatic and Color Photography," "The Evolution of Photography," "Carbon Printing" and "Pictorial Photography," Mr. Bayley had the active assistance of Sir William Abney, General Waterhouse, Mr. J. C. S. Mummery, M. Demachy and Mr. Alfred Stieglitz, respectively, thus adding to the value of his book as a source of authoritative information on these thorny topics. The chapters on "The Drawing of a Photograph" and "Exhibitions and Societies" also deserve special welcome as dealing with subjects not usually mentioned in photographic textbooks, despite their vital interest to every ambitious amateur. If we may suggest a change or two in succeeding editions, we should like to see the sections which deal with panoramic and focal-plane work amplified, while the paragraph on ozobrome printing needs revision and extension.

⁂

Investigations on the Theory of the Photographic Process. By S. E. Sheppard and C. E. Kenneth Mees. 342 pp., with numerous diagrams. New York and London: Longmans, Green & Co. Net $1.75. Postage 10 cents.

This is emphatically a book for the advanced student; we had almost written "for one man in a thousand," but the fact that more than five thousand copies of THE PHOTO-MINIATURE No. 56 have been sold in this country, tells us that the field of possible readers for such a work has widened during the last few years. Nevertheless, we would not advise the average photographic worker to purchase the book until he has read and intelligently grasped the significance of what is set forth in simple language in No. 56 of THE PHOTO-MINIATURE series. Briefly described, the work is a collection of certain investigations in the physical chemistry of exposure, development, the action of restrainers and fixation, with a careful account of the special apparatus employed by the experimenters in their work. Much of the information given is summarized from the papers read by Messrs. Sheppard and Mees before the Chemical Society, the Royal Society and the Royal Photographic Society during the past two or three years, and we welcome the appearance of the book as giving these papers in a more convenient and accessible form for further study and reference.

It is to be hoped that the authors will follow this volume with others upon the same general lines, but giving, if possible, the practical conclusions of their investigations in simpler form than they appear in the volume here noticed.

⁂

Wellcome's Photographic Exposure Record and Diary, 1907. 260 pp. Pocket size. 50 cents. Postage 3 cents. New York: Burroughs, Wellcome & Co.

This well-known European exposure pocket book—the best of its class—is now adapted for use in America, and will doubtless quickly win here the wide popularity it enjoys on the other side of the Atlantic. It contains a surprising amount of useful information for its size, ruled pages for the record of negative and positive exposures, comprehensive tables of subjects, plate speeds and light conditions, with an exposure calculator giving the required exposure by a turn of the dial. We have used the Wellcome Record for years, and consider it an indispensable aid in our work.

❧

The Photographic News Year Book of Photography 1907–8. Edited by F. J. Mortimer. Paper covers, 50 cents. Postage 15 cents. American Agent: G. Gennert, New York and Chicago.

Since Mr. Mortimer took over the "News" and its "Yearbook," they have undergone a veritable transformation and may now be fairly counted among the things which no progressive worker in photography can afford to miss. The "Yearbook" just issued is a splendid piece of work and full of interest from cover to cover, closely rivaling the unsurpassable "British Journal Almanac." As in past issues, the principal features are the Editorial Review of the progress of photography during the year, and five lengthy papers contributed by as many practical workers in different fields. The first of these is by Mr. Mortimer, and deals with "Seascape and Yacht Photography," a capital supplement to his monograph on "Surf Photography" in THE PHOTO-MINIATURE Series. This is followed by articles on "Landscape Photography" (Warburg); "Portraiture" (Hewitt); "Architectural Photography" (Bennett); and "Flower Photography" (Seymour). The sections devoted to the Trade Directory and the Photographic Societies are perhaps of minor interest to the American reader; but the pages of Photographic Formulæ and Data abundantly make up for this by their wealth of useful information. The book has met with great success in Great Britain, and is sure of a wider circulation here as its usefulness becomes generally known.

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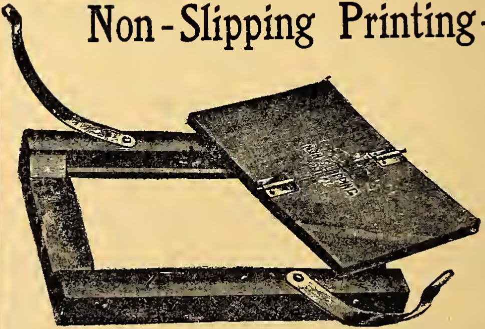

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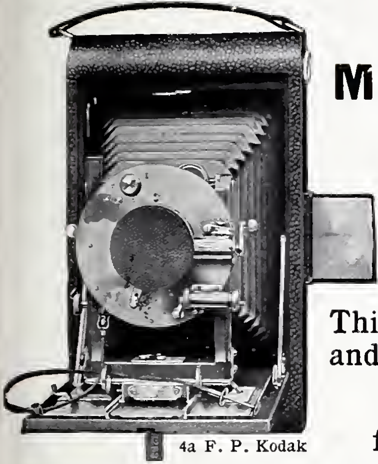

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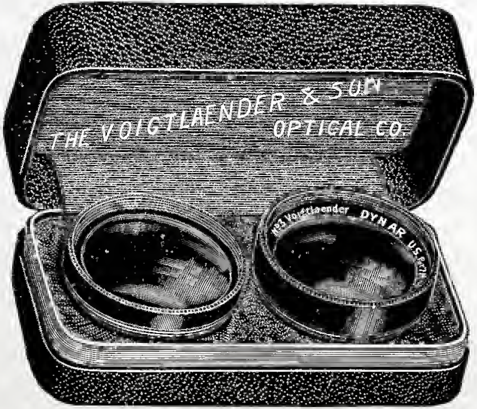

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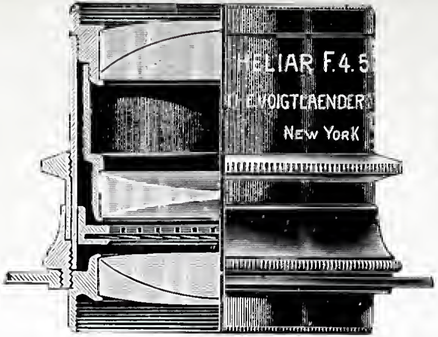

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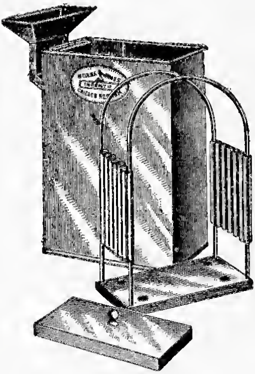

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NO.	SIZE	PRICE
6	3¼ x 4¼ or L. S.	$2 00
7	4 x 5	2 00
8	5 x 7	3 00
9	6½ x 8½	3 50
10	8 x 10	5 00

STYLE B—Made of Zinc, for Developing and Washing only. Fixing cannot be done in this tank.

NO.	SIZE	PRICE
1	3¼ x 4¼	$1 00
2	4 x 5	1 00
3	5 x 7	1 50
4	6½ x 8½	1 75
5	8 x 10	2 00

Style "B"

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Color Values In Pictures Taken On Ansco Films

COLOR VALUES in black and white are as effective in reproducing nature as the actual colors. A dry point or an etching by Whistler has in the fine shades of black and white the force of the color values which the camera makes possible with the Ansco film. All film may be truthfully advertised as being orthochromatic, for there is no difficulty in making a film sensitive to one or more colors. The art is, to make it sensitive to the right colors and in the proper degree, so as to produce the various tints of black and white necessary to create the correct illusion.

A Liquid Landscape, by F. R. Wyckoff

Ansco Film

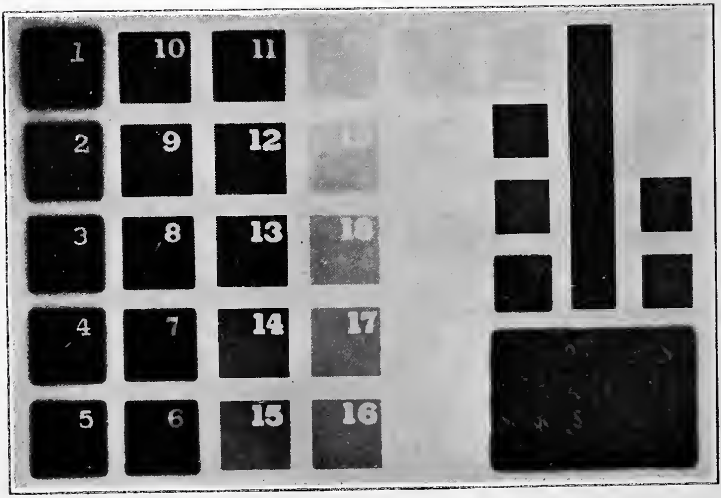
For practical purposes the film should be very sensitive to green and yellow, on account of the green foliage and in order to make instantaneous pictures possible on hazy days and late in the afternoon, when yellow light prevails. It should be only moderately sensitive to red, so as to prevent fog in developing by ruby light. The excessive sensitiveness to blue and violet which all films are likely to possess must be decreased in relative proportion to the sensitiveness to red, yellow and green.

For comparative demonstration, we illustrate these pages with reproductions of tests made on the two well-known films, Ansco and Eastman, by means of the Chapman-Jones plate tester. This comparative chart will enable the photographer to determine which film has the color values and sensitiveness better adapted to his requirements.

Advantages of Harmonious Color Values

as shown in the test of Ansco Film, are as follows:

IN view work, where there are clouds and foliage, or work embracing great distances, the finer details are retained and a harmony of light and shade is secured. In portrait work, the draperies,



Ansco Film

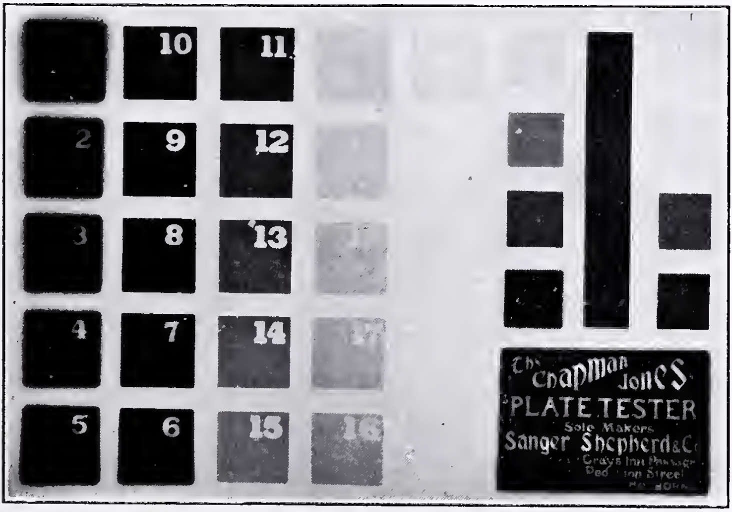
dresses, etc., are reproduced in their true color values. Auburn hair will be reproduced in a different tone from black hair. Blue eyes will not be represented as almost white.

An Equally Important Point

WITH the marked improvements mentioned, the Ansco film still retains that fineness of grain of the emulsion so necessary in producing a well-balanced negative, with details in the shadows and delicate half-tones in the high lights.

Keeping Quality a Convenient Advantage

ANSCO films as now made will keep in good condition during the time for which they are guaranteed under almost any climatic conditions and will last almost as long as a dry plate, if proper care is taken of them.



Eastman Film

Ansco Film is *the* Film with Experience Behind It

THE photographic experts who make Ansco film have benefited by the failures of other manufacturers in attempting to produce a perfect result.

Try It

YOU may have used Ansco films several years ago, or even a year ago, but remember that the creeping child of yesterday is the mighty athlete of to-day.

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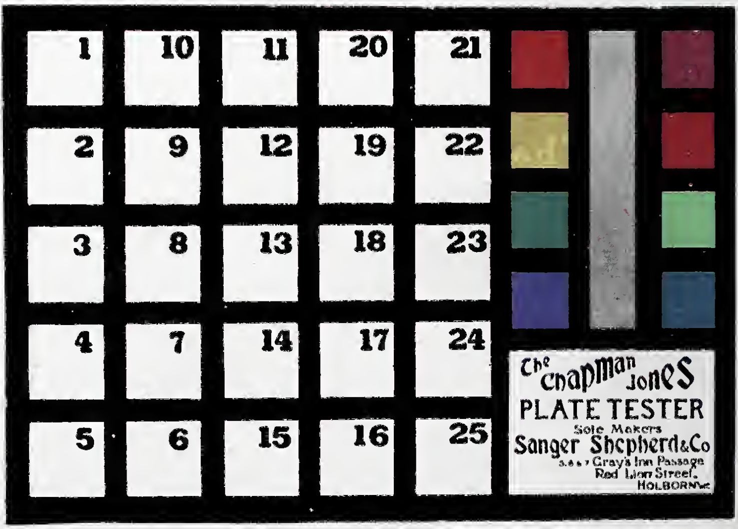

Chart for test of color values and rapidity

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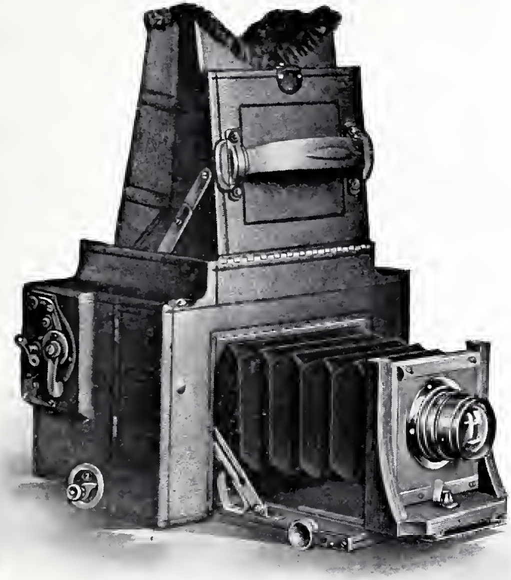

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The 3A Graflex takes 3A (3 1-4 x 5 1-2) Kodak Film

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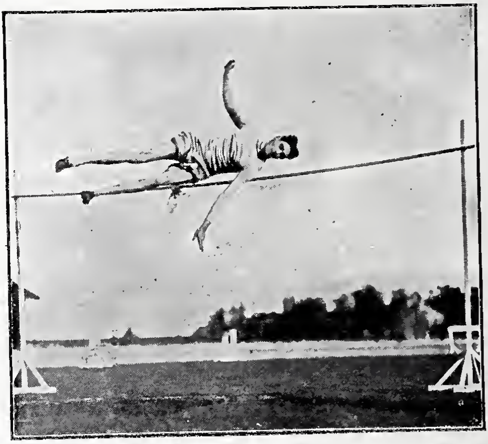

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VARIETY

Although the summer glories have not as yet become a memory, and the out-of-doors still holds a multitude of photographic attractions, most of us have accumulated quite a stock of summer negatives for printing.

To most of us, the printing-up of the negatives possesses an attraction equal to the taking of the picture.

We are a bit apt to get in a rut, and while perfecting ourselves in one printing process, are prone to overlook the advantages of others equally good—hence these few suggestions.

First, there is Velox—practically enough variety here to suit the most fastidious—but, have you tried "double weight" for some of those particularly artistic bits you want to send prints of to distant friends.

How about re-development for sepia tones, it's as simple as can be, and the results are charming.

Then there is Royal Velox, coated on a delicate cream-colored stock, and just rough enough to give sparkle and roundness to the shadows.

Royal Velox is delightful when printed the ordinary way, and when re-developed for sepia tones, the most apt comparison is an old etching toned and softened by time.

When you mention Platinum printing to some amateurs, they say "Phew! that's too difficult,"—an entirely false notion, as W. D. Platinum, while a pure platinum paper, is exceedingly easy to judge for printing depth, and requires only *hot water* for development—this paper may be had in both smooth and rough.

Then there is Eastman Sepia Paper, as simple to handle and much quicker than "blue print," and just the paper for broad sketchy effects.

Perhaps you are a bit literary and wish to send an illustrated story to some one of the magazines, for your illustrations there is the old standby, Solio; most editors demand prints on Solio, as their engravers seem to think it ideal for the making of half-tones.

And then—Enlargements: Since we have found out how simple the process of making Bromide Enlargements really is, we all have the fever, and for our purpose Eastman's Permanent Bromide Papers can be had in great variety of stock and surface.

Just a suggestion, try enlarging on Velox, it's slower considerably than Bromide paper, but the results more than warrant the extra expenditure of time, and there's no dark-room.

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EMERGENCY CASES

VARIATION FROM STANDARD TIME AND TEMPERATURE IN TANK DEVELOPMENT

It sometimes happens that, owing to conditions uncontrollable by the amateur, it is not possible to secure and maintain the standard temperature of 65 degrees Fahr. when using the Kodak Tank and the Eastman Pyro Tank Developer Powders.

Countless experiments have demonstrated that 65 degrees Fahr. is the most practical temperature for the developer solution when time of development and proper density of the film negative are considered.

This temperature is, under normal conditions, easy to maintain, and does not prolong development unduly.

Using double strength developer and cutting down the time to ten minutes with the standard temperature at 65 degrees, will produce equal results.

The relation of time of development and temperature of developer is most important, and is the foundation of success with tank development.

That one may, within certain limits, depart from the standard temperature of 65 degrees Fahr., and by lessening or prolonging the time of development, secure good results, is evident.

However, we do not advise any departure from standard time and temperature except in cases where normal conditions do not obtain.

As a guide in emergency cases, we append herewith the result of a series of tests that are sufficiently accurate for all practical purposes.

Standard, 1 Powder. Temperature, 65° Fahr. Time of Development, 20 Minutes

TEMPERATURE	TIME OF DEVELOPMENT
70 degrees	15 minutes.
68 "	17 minutes.
65 " normal	20 minutes.
60 "	25 minutes.
55 "	30 minutes.
50 "	35 minutes.
45 "	40 minutes.

Standard, 2 Powders. Temperature, 65° Fahr. Time of Development, 10 Minutes

TEMPERATURE	TIME OF DEVELOPMENT
70 degrees	8 minutes.
68 "	9 minutes.
65 " normal	10 minutes.
56 "	13 minutes.
50 "	15 minutes.
44 "	17 minutes.

Eastman Kodak Company

ROCHESTER, N. Y., *The Kodak City*

Developer must never be warmer than 70 degrees Fahr.

It will be noted that it requires just double the time for development between 65 degrees, the normal temperature, and 45 degrees when using one powder, and nearly double the time when employing double strength developer.

The variation in the temperature of the atmosphere will make some difference in the results, but not sufficiently so to be taken into serious account. At low temperature some difficulty may be experienced in dissolving the developing powders; crushing the powders very fine and adding slowly to the water while stirring will lessen this difficulty.

Always, when possible, stick to normal temperature and time, as they naturally tend to simplify the obtaining of good results.

The above tables, showing the wide variation in time necessary to obtain proper density at different temperatures, will fully demonstrate the important part temperature plays in the science of tank development.

HANDY

Many times one wishes to develop just a six exposure or a "double two" roll of film, or make a few Velox prints for some special purpose.

To make up two special developers for so small an amount of work would be a bit irksome, and one would be inclined to defer the developing or printing to some future time when it could be done with other work.

Here is where Nepera Solution, the universal developer, comes in.

Just diluted with the proper amount of water, it is a splendid developer for Velox; or, if needed for film or plates, dissolve one of the little capsules accompanying the liquid, add it to your solution, and you have an unsurpassed developer for the purpose—and Nepera Solution doesn't cost any more than the ordinary one-purpose developer. Ask your dealer.

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April 9th-12th.

Angelo Sepia Platinum secured the Medlar Trophy.

Angelo Sepia Platinum secured the Grand Portrait Prize.

Eight prints were selected for the Daguerre Memorial. Four of these were on Angelo Sepia Platinum.

Photographers' Association of Pennsylvania

April 23rd-25th.

Salon honors and five blue ribbons to Angelo Sepia Platinum.

Photographers' Association of Wisconsin

April 23rd-25th.

Angelo Sepia Platinum secured the Rice Trophy.

Photographers' Association of Missouri

June 18th-20th.

Three first Prizes to Angelo Sepia Platinum.

Photographers' Association of Indiana

July 8th-12th.

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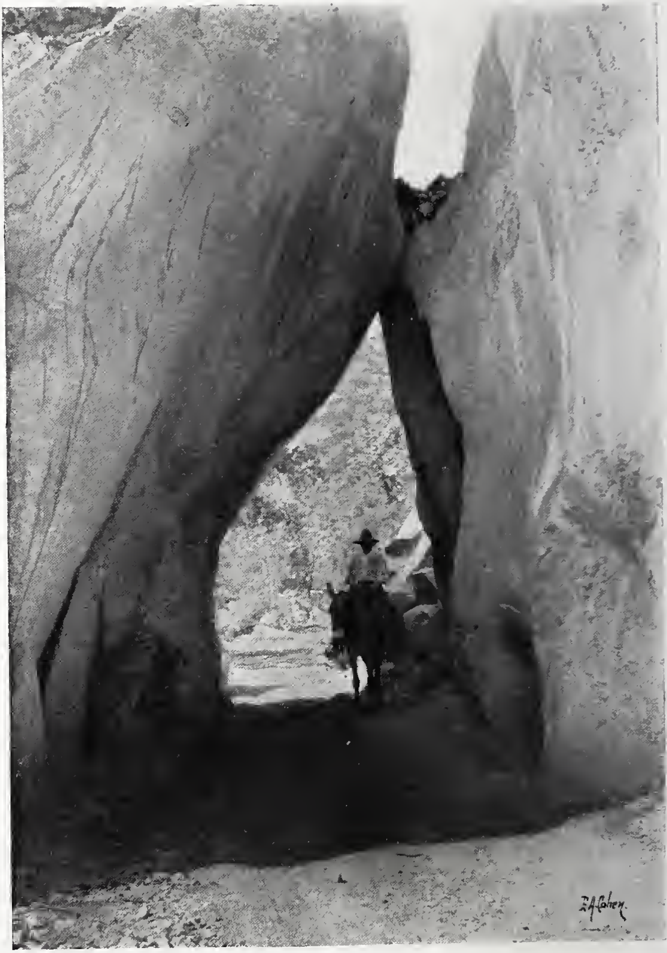

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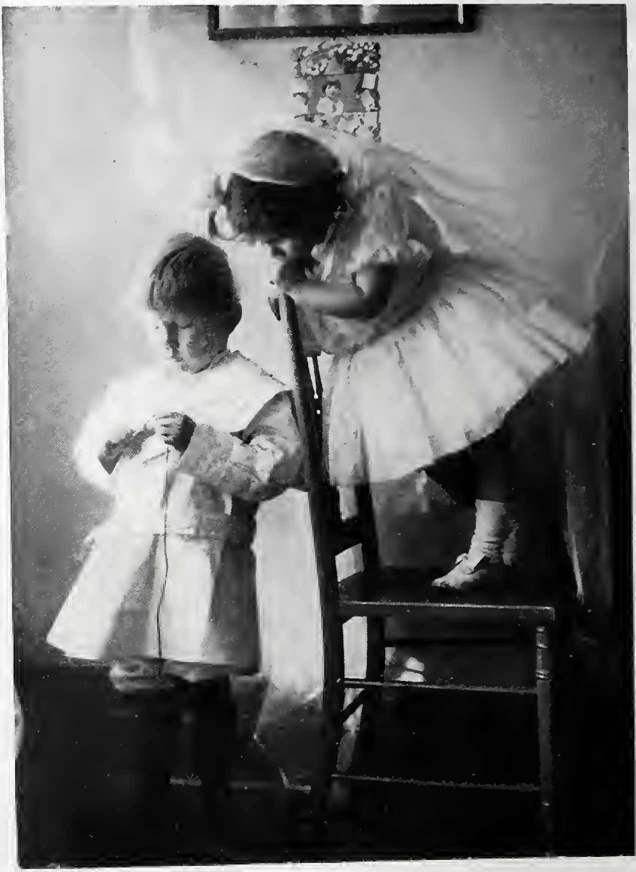

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EDITED BY JOHN A. TENNANT
Volume VII OCTOBER, 1907 Number 82

Modern Dark-Rooms

It may seem paradoxical to begin a book avowedly devoted to the dark-room with a dissertation on the possibility of dispensing altogether with this one-time necessity in photography. But photography is progressive and its manipulations have already been so far simplified by the introduction of methods combining ease and efficiency that it is now an every-day possibility —at any rate outside of studio portraiture — to do thoroughly good work without a thought of the dark-room.

Thirty years ago the photographer who ventured afield with his camera carried his dark-room with him, "folding his tent like the Arab," and packed into its ample folds the silver bath and other bulky impedimenta of "good old wet collodion days." In those days the carefully cleaned glass plates had to be collodionized, sensitized, exposed and developed on the spot, before the emulsion had dried. Then came the dry plate, which could be kept for months before exposure and left undeveloped for months after, if desired. It looked as if the golden age had come at last. The photographer's kit was at one swoop reduced to camera, tripod and a few plate-holders. The amateur, as we know him today, increased and multiplied. Photography became a popular hobby instead of the recreation of a leisured few with leanings toward scientific experiments. Since then its almost imperceptible evolution has amounted to a practical revolution.

Evolution As part of this evolution, the clumsy box with a strap handle, facetiously named a "detective" camera because of its fancied unobtrusiveness, has developed into the really remarkable hand-camera of today with a carrying capacity of twenty-four or more exposures; the plate-holders, which had to be filled in the dark-room, have been replaced by the daylight-loading cartridge film, the plate magazine and the ingenious film-pack. And now both films and plates may be changed, developed and fixed in daylight by the use of cleverly devised tanks, so compact and dainty in their construction that my lady can carry one in her hand-bag without perceptibly adding to its weight, or fear of soiling the most delicate lingerie; or the military photographer on the fighting-line can sling the tank on his belt with his water-bottle and develop his day's exposures at the most convenient mud-puddle en route. And, be it noted, these concessions to the great god convenience have been granted, not at the expense of, but with added efficiency, for they are based on careful research and the elimination of uncertain and haphazard methods.

Expedients Of course, these things were not achieved in a day. For years inventors attempted to obviate the dark-room and its terrors; but their efforts were more admirable for their ingenuity than for practical usefulness. Thus, there was the suggestion, revived not so long ago, that the developing solution should be tinted with a non-actinic dye, which would act as a safe light. Once the plate was immersed in this colored developer, the progress of development could be watched by weak daylight or gaslight, the appearance of the image being visible through the solution, protected by its color from destructive light action. The method is practical—or rather practicable—as far as it goes, but deservedly obsolete. The curious reader who may wish to try the experiment will find a satisfactory dye color in rosaniline —a few drops of which are sufficient for each development. Other expedients were suggested from time to time, the most promising of which was the "pocket dark-room," an ingenious device closely resembling the familiar F. P. K. and intended for the development of roll-films in daylight. But they have disappeared from view and are not lamented. Out of them all has come what is generally known as the tank method, a practical method of daylight development which completely eliminates any need of a dark-room in negative making.

Tanks of Today

Tank development, however, is not new: It was recommended and quite extensively practiced fully twenty years ago by many European photographers. The early apparatus, however, was somewhat crude and a dark-room of some kind was essential at the beginning and end of development, so that one may fairly say that the advantages of the method were not generally appreciated until the Kodak Company introduced its now well-known tank method for the development of roll-films,—cleverly linking the advantages of the "time and temperature" method with the practical convenience of the light-proof tank. Along with this innovation, other manufacturers brought forward tanks suited for the development of plates and cut films. Of these the *Auto*, *Ingento* and *Aucelo* may be found in the American market, while the best known British tanks are the *Standa* and the *Rystos*. With all the plate tanks a dark-room is necessary in placing the exposed plates in the developing solution in the tank; but with the kodak tank for roll-films the exposed film can be manipulated throughout in subdued daylight or gaslight. One of the Ingento plate tanks is made of nickled brass, so that the plates can be developed, fixed and washed without removal from the tank—a decided convenience. The rule for successful development with these tanks may be expressed in the phrase "Go by the book," the different makers supplying manuals of instruction giving formulæ and methods which, by experiment, are calculated to give the best results with a minimum of trouble. As soon as the worker feels that he is sufficiently familiar with the method chosen, many little modifications will suggest themselves as giving elasticity to the system without the loss of its peculiarly advantageous features.

With this brief survey of the modern way of photography without a dark-room, let us now take up our consideration of the dark-room as a necessity to the professional worker, as well as to the amateur who uses plates or still prefers to follow the older ways of photographic manipulation.

Real Dark-Rooms

The photographer's dark-room has stood the stress of more than half a century with as little change perhaps as any department or appliance connected with photography. In the beginning it was a place where the sensitive plate might be manipulated beyond the influence of actinic light, and such it has remained until today. With the appearance of the highly sensitive gelatine dry plates, the red-lighted dark-room as we know it became universal. Perhaps it is because the earlier photographers were often tinged with a shiftless Bohemian carelessness, perhaps the great latitude which photography allows its followers encouraged this; whatever the reason, certain it is that the dark-room commenced as somewhat of a hole and corner arrangement, and that it has so continued.

With the amateur who is merely following a hobby this is natural enough. His room is used only occasionally, and for limited periods of time; and his enthusiasm will counterbalance his inconvenience. But with the professional it is otherwise; the stuffy inconvenient dark-room exists in connection with hundreds of studios, where probably it has existed from the beginning and is regarded—if regarded at all—as a matter of course. Often in professional work every available inch of space is given to display in one form or another—to reception-room, dressing-rooms, or studio—and the work-rooms are cramped in consequence, the dark-room most of all. But even with a small dark-room it is often possible to have conditions approximating to comfort. We may not set back our walls to enlarge our space but we may improve its ventilation or abolish a feeble red glimmer in favor of a light equally safe, but which will reasonably illumine the room and ease the strain on the eyes. In this little book we will endeavor to consider some of the problems connected with the dark-room, in the hope that such consideration will prove useful to many who at present develop under hampering conditions.

Size

In constructing a convenient dark-room we require size sufficient to allow the various operations to be conducted without overlapping, and no more. A room which will give space for a worker without cramping him, after a sixteen-inch shelf has been run around three sides of it, is sufficiently large, and except for ventilation, no advantage is to be gained by increasing its size. We require a good sink and water supply, a safe light, adequate ventilation, heat in winter, working benches, and racks and shelves for holding bottles and trays. As for actual size, if the room is never occupied by more than one worker at a time, about seven by five feet would not be too small—though one larger would be preferable; this would give a working space of about five and a half by two and a half feet; or four and a half by three and a half according to whether the double row of benches ran the long or the short way of the room. Often the dark-room is partitioned off from some other room, and is long and narrow, with the sink and shelves running along one side only. This is a convenient arrangement. In speaking of a room of small size it must be remembered that we are speaking only of a dark-room, not of a work or storeroom. The dark-room should not be used as a general storeroom, for chemical fumes or heat may have a deleterious action on stock. Much of the writer's dark-room work has been done in a closet measuring about five feet by thirty-three inches, but possessing the great advantage of a porcelain bowl with running water; and many workers will, like him, be bound by actual rather than by ideal conditions. But these makeshift dark-rooms are possible to amateurs only and are dealt with on another page.

It is not possible to give any actual dimensions for a room. Many photographers never handle larger sizes than 8 x 10, while the greater proportion of their work is smaller. Where sizes up to 17 x 22 are handled, the minimum size suggested above would be quite inadequate.

The Sink

The position of the sink will be determined by the position of the window, if an outside light is used. Whatever light is used, it should be sufficient to clearly illumine the room, and so the developing sink should not be directly under it. If the window is towards a corner, the sink may be on the same side but towards the opposite corner, and so in direct shadow of the wall. Figure 1 shows a plan of a dark-room with such a window; it is drawn small, as it is very simple and merely suggestive. A is the sink, and B a slightly sloping lead-covered shelf; C, D and E are the remaining shelves, C and D being used for working in connection with fixing and toning or any manipulation calling for dishes or graduates or mixed solutions. E, is kept clean and religiously confined to changing of plates, the handling of paper, or similar clean operations which must be kept away from dust and chemicals.

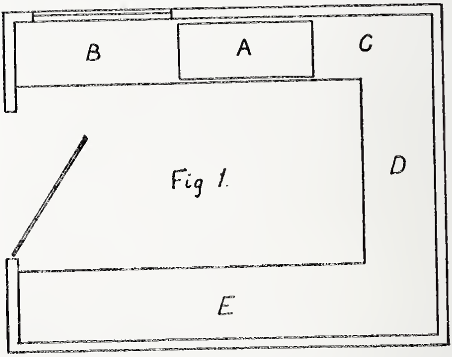

Fig 1.

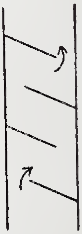

Fig 2.

Various Sinks

Sinks made of porcelain may be bought and are in use in very many dark-rooms; their chief defect—apart from cost—is their hardness. If a plate, or measure, or dish is dropped on or struck against the sink, a breakage usually results. In making or choosing a sink, do not let it be too small. The size will depend of course on the plates handled in it, but 28 x 14 x 4 inches will not be too large for medium-sized work. If a size larger than this is required, porcelain will prove very expensive, and it would be better to use a wooden sink lined with lead, or a cement sink. A lead-lined sink is often used; it has the initial advantage that it may be easily home-made, although commercial sinks of this sort are readily obtainable. Then, too, the softness of the lead saves many breakages, for a plate or a graduate accidentally dropped does not inevitably break, as it does in a porcelain sink; and the lead is not affected by the chemicals commonly used by photographers. The basis of a home-made sink should be a firm box of one-inch wood. A hole in one corner should be bored and fitted with a waste-pipe, and then the box lined inside and along its upper edges with the thinnest sheet-lead obtainable. A cheaper sink, satisfactory for amateur work, may be made by coating the wooden box with several coatings of Probus, Brunswick black, or some similar preparation. It is inevitable that we shall make frequent mention of Probus in this monograph because of its peculiar usefulness in the dark-room. Hence, a few words about this preparation may profitably find room here without suspicion of advertisement. The persistent need of some sort of preservative paint in the dark-room is obvious to any one who has had dark-room experience, and Probus is simply a commercial preservative paint or varnish, and the best of its kind, within our knowledge. Applied to wood, fiber, or similar compositions, tin or iron, it renders the material proof against water, acids, alkalies and rust, effectually replacing Brunswick black and all other preparations of the sort we have yet tried. It lends itself splendidly to the home production of wooden trays, sinks, and similar receptacles used in photographic workrooms, combining economy with comfort and efficiency in use. Used as a paint for sinks, shelves and floors, it means a clean, dry dark-room, and will be found indispensable.

A Cement Sink

A home-made sink with advantages where a dark-room is permanent is the cement one described by Mr. A. B. Stebbins at a recent professional convention. On a solid foundation, where the sink is to finally rest, a box is built of one-inch lumber for the outer mold of the sink. This mold should be four inches longer and broader, and two inches deeper than the sink required. An inner pattern or core is made with outward dimensions 4 inches shorter and narrower and 2 inches shallower than the outer mold. This is suspended in the outer molds by laths nailed to its upper edge. The cement is made by mixing 3 parts of clean sand with 2 parts of Portland cement. Fit the escape-pipe in position before pouring in the cement; this pipe should project about 1¾ inches above the bottom of the mold, and be plugged with a cork. Mix the cement fairly dry (Mr. Stebbins recommends calling in a mason at this stage), fill the mold, and let it set for two or three hours. The core can then be drawn away and the mason with the trowel smooths off the work. The outer mold is left in situ, and with a smooth facing-board, and, if desired, a casing along the upper edge, the sink is complete. It is not affected by any except the strongest acids; will neither stain nor retain moisture or odors, and can be easily scrubbed clean. Such a sink may be built in large size, at a very reasonable cost—practically the price of the Portland cement and the mason's labor. Its weight necessitates that it be built where it is to remain, and that it be placed on a substantial foundation.

The Table

The shelf B in figure 1 is used to hold graduates, dishes, etc., while development is going on. It should slope very slightly towards the sink and if of water-proofed wood should have shallow grooves running towards the sink to carry off spilt solutions. Or preferably, it may be covered with thin sheet-lead, when it can be cleaned with a hard squeegee. A narrow beading slightly raised along the front edge will keep the moisture from dripping down the front.

Developing Frame

Development should be done, or at any rate commenced, over the sink. Make a framework by nailing half a dozen laths, with an inch space between each, across two one-inch square pieces of wood about a foot long and just far enough apart to fit snugly inside the edge of the sink. The laths projecting an inch beyond these battens at each end will rest on the sink, and the battens will prevent slipping but will allow the table to be pushed from side to side in the sink. The frame should be water-proofed with Probus. A similar arrangement, to slope under the tap, is useful for washing negatives.

Water A good supply of water is essential in the dark-room. There should be two taps over the sink and one of them should be sufficiently high to allow of filling the largest bottles under it. The water, when running into the sink, may cause splashing; to prevent this, a short length of rubber piping may be slipped over the end of the tap, or a piece of thin cloth a couple of feet long and a few inches wide may be thoroughly wetted and then wound tightly round the tap so that the projecting cloth forms a tunnel through which the water will fall. This cloth may cling to the tap if tightly wound, but it is safer to hold it in position by slipping a strong rubber band over it, or using a piece of string, to ensure its not slipping from the metal pipe. This cloth will tend to make the water fall in a soft even column instead of a splashing stream. Filters which scarcely affect the flow of water may be purchased at a nominal price. The filter itself is a piece of fine wire gauze in a brass socket which attaches to the tap by means of a rubber washer; and it not only checks splashing but also arrests any solid particles in the water. The second tap should be fitted with a fine rose jet. These are to be bought mounted on a swivel tap by which the rose may be swung against the wall when not in use. When pushed against the wall the water is automatically turned off; when drawn forward over the sink it gives a fine spray which will evenly rinse a plate without at all damaging the film.

Ventilation Ventilation is the one vital matter in dark-room construction which may be overlooked. A worker must have light and water-supply, and they are tangible things which he cannot forget; but he may essay to forget ventilation. In a dark-room we cannot have open windows, though we ought, if possible, to have a thorough "blow through" and airing when the room is not in use. The airing and ventilation must, however, be free from dust. If the room has a fireplace or flue it may provide an outlet, but an inlet for the air will be required. This inlet may be through the door or one of the walls, where a hole should be cut to admit a "trap" ventilator as shown in Figure 2. The inside and the projecting wings should be painted black, when they will stop all light from entering. Where a chimney is built over a gas or oil lamp this will create an outlet for air. In the absence of any flue, two traps must be used, one for inlet and one for outlet. Ventilators are of little use in sluggish air; if the dark-room is built in a corner of a larger room or passage where the air is still, some means of assisting the ventilator will be advisable; if an electric fan can be installed the difficulty is solved. The fan should not merely stir up the air in the room; it should be so placed that it will drive its current of air towards one of the ventilators, and so out of the room; fresh air will then enter through the other ventilator. A still simpler method of ventilating is to bore a number of holes through the door or wall, and shade them with a sloping board to make them light safe. The holes should be reasonably large—say one inch in diameter—and they should be numerous to allow sufficient air to pass.

More Air

The usual plan is to use two ventilators, one near the ground to admit air, the other near the ceiling, for its escape. But ventilators do not necessarily give ventilation. The reason for the common placing of escapes near a ceiling is that heated air always ascends, and ventilation is usually needed when a place becomes hot. But it may be that the best ventilation of a room is to allow a current of air to pass directly through it. No rule can be given about this, but emphasis may be laid on the fact that air does not move without cause. In a trapped ventilator, such as that shown, each wing tends to check the air, and so the ventilator must be much larger than if it were a simple grating.

Temperature

An even temperature in a dark-room is essential. The comfort of the worker is a minor consideration in this—it is the correct development of the plates themselves which is affected. A slight variation in temperature has a more than slight effect on the duration of development. The standard usually quoted is 65° Fahr.; if the weather is cold and the developer is only 50°, the action will be so sluggish that development will take more than twice as long. If on a hot day the thermometer in the dark-room climbs to 80°, the time of development will be halved. Temperature has been one of the most important of the variable factors which have made development so much of a gamble. What to do in summer is a problem that has never been satisfactorily solved. If the water from the faucet is cold, the developer may be cooled in it, and the tray held in a stream of it during development. A bowl of ice may be usefully employed sometimes, but the chief thing is to have a thorough ventilation, and remember that a dark, ventilated space is a cool space; it is the closed-in room with stagnant air which becomes heated and stuffy.

Heat

The problem is simpler in cold weather, for it is easier to warm than to cool a room. A jug of hot water is the veriest makeshift, though it is useful at times; and solutions have been successfully kept warm during development by the judicious use of an india-rubber hot-water bottle. Bottles of developer may be kept warm on a rack just above the lamp, but the satisfactory way is to use an oil or gas stove. Where gas is connected, a hot Bunsen flame can be got with little light; and there are air-burning oil stoves which give little light. The small amount of light there is can easily be shielded, either by a sheet of some non-actinic material or by a piece of wood or metal. A lamp in the dark-room will materially assist ventilation. A chimney should be carried from it through the window or wall, or up to a ventilator, and as it carries off the fumes will cause an influx of outside air to the room. The stove should be lighted some time before the room is to be used, for chilled bottles will heat much more slowly than the air. It is necessary that the bottles be warmed before solutions are poured from them, for with some developers, such as hydroquinone and eikonogen, a portion of developer crystallizes out in cold weather. And solutions of caustic alkalies settle in cold weather, the solutions being stronger at the bottom than at the top of the bottle, though the difference is not visible. A thermometer is necessary in the dark-room, and the temperature should be carefully regulated to keep about 65° Fahr.

Illumination Much depends upon the correct lighting of the dark-room. There are two main factors to be considered—the safety of the light as towards sensitive films, and the worker's comfort. This latter factor has too often been overlooked. To obtain "safety" photographers have been content to work with the dimmest of dull lights. A glimmer through a deep ruby glass is one of the commonest mistakes; for it is quite possible to combine safety with a fair volume of light; and light of a tint which does not affect the eyes unpleasantly. The light may be either day or artificial. One disadvantage urged against the former, by those who can do their work during daylight, is that it is variable in intensity, but this argument is valid only with those who closely examine their negatives from time to time during development, to judge density, a custom which is largely dying out. In regard to a "safe" light, it is much a question of how close and for how long a time the plate is held to it. A light that illumines the dark-room so that every bottle and package can be seen, would probably be safe, if the plate to be developed were taken from its holder and at once placed in the developer and covered over; but the same plate might fog if the developing tray were held close to a much weaker light, in an endeavor to see the first indication of any image.

Daylight A window may be utilized by glazing it with colored glass, or by covering the clear glass with colored paper or fabric. The fabric may be pasted on the glass, or, preferably, mounted on a frame to fit the window. This frame should be made of light, flat laths, and just large enough to fit snugly over the window sash, close to the panes. With a couple of staples at the top of the window for the edge of the frame to be slipped under, and a turn button at the bottom to hold it tightly in place, it can be put up in a moment. A strip of thick felt tacked along the edges of the frame will provide against shrinkage and ensure a snug fit in the window casing. A common mistake is made of entirely blocking the greater portion of a window, leaving a small opening of perhaps a foot square; it would be more comfortable to have the opening two or even three feet square, and this is quite feasible if a suitable medium is used.

Glass and Fabrics

There is much difference in glass which to the eye appears of the same color, and it is not sufficient to use any piece of yellow or red glass—for many colored glasses are by no means safe filters, passing light of other than their own color, and sometimes passing stray white light. We will, however, discuss glass in connection with artificial light, for paper or fabric is the material usually employed when a large area, such as a window, is covered. There are many papers and fabrics on the market, usually yellow, orange or ruby, the best we know of being the Ruby Christia materials, of British make. The fabric generally transmits more light than the papers, and is more expensive. But this extra cost is more than compensated by its durability, particularly when stretched on a movable frame. Except in very closely woven cloth there is danger from tiny rays of white light penetrating the meshes, but this can be avoided by using a double thickness of the fabric. This use of two or more thicknesses of fabric is very usual, and very effective in checking undesirable light. The term "safe" applied to a medium is a relative one, for probably none of the materials on the market absorb the undesirable rays completely. Yellow medium, for instance, transmits the red and green (which, together, form yellow) and absorbs the blue. But it does not transmit *all* the yellow or absorb *all* the blue. Let us suppose that a yellow paper transmits one-half of the yellow rays, and one-tenth of the blue rays. If we add a second sheet of paper we again reduce our yellow one-half, or one-fourth the full illumination; but, at the same time we reduce our blue to one-tenth, or only one-hundreth of the original intensity; and if we add a third sheet we still retain a working yellow light of one-eighth intensity, while the blue has been reduced to one thousandth and for all practical purposes, eliminated.

A Safe Light

A sheet of deep orange glass, and one of ruby bound together should give a safe light for all ordinary dark-room purposes; where rapid orthochromatic plates are to be developed, or where sunlight falls on a window, a curtain of deep red cloth should also be drawn across the window. Where fabric is used, a couple of sheets of yellow with one of ruby should be a sufficient protection. In the preceding paragraph we have shown how the addition of a thickness of fabric eliminates the undesirable light in greater ratio than the desirable; and if the light is found to be unsafe the addition of an extra thickness of fabric will remedy matters.

Testing the Light

The wide range of available fabrics with their greater or less efficiency makes it impossible to lay down a hard and fast rule as to a sufficient safety, and brings us to a practical test, to prove our light. Place one of the most sensitive plates used in a holder, and draw out the slide one inch, exposing this one inch to the dark-room light, for, say one minute. It need not be held close against the window or lamp; if placed about in the position which a plate would occupy during development the test will be sufficiently severe. After exposing for one minute draw the slide another inch more open. Expose another minute, and repeat until all the slide except one inch has been exposed. Then develop and fix and look for evidence of any light action, If the whole plate, except the one protected inch is veiled the light is unsafe; if all fixes out clear the light is safe. It may be that a visible trace of fog appears in the three minutes' exposure, but not in the two. If so, the light may still be safe for all practical purposes. Usually a plate is exposed for only a few seconds before being immersed in the developer and the light can have no practical effect on it in this short time.

Position of Artificial Light

There are few photographers, even amongst those who usually employ daylight, who do not at times require artificial light. A light burning for any length of time in a small room tends to raise the temperature and affect development, and, unless the ventilation is good, to vitiate the atmosphere. The best position for the lamp may be outside the dark-room. Where the latter is built off from another room it may be feasible to stand the lamp on a bracket outside a window, or a hole cut in the door or wall. The light used in this case must be one that does not need occasional attention, as some oil lamps do. Where the lamp is in the dark-room we would suggest its being placed, not just over the developing tray, but in some other place, for its primary use is no longer to trace the appearance of the image through every detail of its development. The light may be sufficiently brilliant to illumine every part of the dark-room, making it easy to place hands at once on any bottle or article required, and the plate, at a distance from it, will be more visible than close under the candle glimmer of an old-fashioned ruby lamp.

Lamps

There are many lamps on the market specially designed for the needs of photographers. Attention has been drawn to the great difference in actinic safety in various glasses of apparently the same color. Generally speaking, the makers of lamps are careful to use glass of reasonable correctness. Do not use too cheap a lamp. There are tiny collapsible lamps fitted with slim candles, useful for changing plates or even for occasional developing on a vacation, but small cheap lamps should be avoided in a permanent dark-room. A large lamp should be chosen, and a frosted or fabric covering which diffuses the light is preferable to a clear glass giving direct light and direct shadows. In purchasing a lamp, choose one which gives sufficient light; some lamps are the deepest of ruby, a color not only fatiguing to many eyes but one without commensurate advantages. Among thoroughly reliable lamps at various prices, the new Royal Carbide Lamp, the Montauk and the Ideal Electric lamps are worthy of mention here.

A Home-made Lamp

The colored sides of a dark-room lamp should be changeable or alterable, if the lamp has to be used for general purposes. For bromide paper or lantern-slides, a brighter light is possible than for ordinary plates, while still another light will be required for some orthochromatic plates. The writer's lamp has one side fitted with a yellow glass used for bromide work or for examining plates when development is almost complete, while another side is fitted with two sheets of fabric one yellow and the other red, pasted to the glass. Probably this is technically an unsafe light but we develop orthochromatic plates with it and without any signs of fog. But the plates are taken from their holders at some little distance from the lamp, and immediately immersed in the developer. When the developer is fairly acting on the sensitive film, the light sensitivenes of the film is largely diminished and so when density is being built up the image may, if required, be examined. Chapman Jones recommends a lamp with removable sides, sliding in grooves that are wide enough to carry two sheets of glass with space between for a few thicknesses of fabric or paper. With such a lamp every need can be met by making the small outlay necessary to obtain a few pieces of suitably-colored material. For example, using plain colorless glasses, one or two thicknesses of yellow fabric between them will give a splendid light for bromide paper; two or three thicknesses of yellow and one of red fabric will give a light suitable for ordinary plates, and by adding another thickness of red fabric it will serve well for isochromatic plates. The best solution of the difficulty, however, would be to provide oneself with a series of three properly tested "safelights," such as those recently introduced by Wratten and Wainwright, giving a maximum of illumination with perfect safety. As to the many possible alternatives, a few will be sufficient to indicate their character. For the first light, a yellow glass and a colorless ground-glass may be used; for the second, a sheet or two of yellow fabric may be added to these, or four or five thicknesses of yellow fabric may be put between plain glasses; and for the last, a sheet of ruby glass may be used instead of the red fabric. Colored papers also are useful, but generally they transmit less light than the fabrics in common use. The chief warning necessary is that ruby glass should never be used alone, because it transmits an amount of blue light that is useless for illuminating purposes and dangerous to the plate.

Home-made Safe Lights

There are several safe home-made lights, for orthochromatic workers. A simple formula is that of Dr. Miethe. Two unexposed negatives, fixed out and washed, or two pieces of glass coated with gelatine may be used. If clear glass is used, coat with 1 ounce gelatine emulsion in 5 ounces of water. Allow 3 ounces of solution for a glass a foot square. Let the coating dry and then soak one glass in naphthol yellow, 150 grains, and water, 10 ounces. Soak the other in methyl violet, 45 grains, water, 10 ounces. Soak in each case for 20 minutes; rinse, and dry, and bind the plates together, film to film. An alternative is to soak one plate in a solution of 1 part of aurantia in 100 parts of distilled water. This must be heated gently to dissolve the aurantia. The other plate is soaked in a solution, 4 parts of rhodamine in 100 parts of distilled water. The aurantia-tinted plate absorbs only the blue rays; the rhodamine plate passes the blue rays, but arrests the yellow, green and violet. The two plates should be bound together, or cemented, faces inward, with Canada balsam, when they will form a safe medium for developing the most sensitive plates. But safe lights for the dark-room can be purchased much more cheaply and satisfactorily than they can be made at home.

A Bichromate Lamp

A 6 per cent solution of potassium bichromate has been recommended as 250 times safer than ordinary orange glass, and if a little eosine is added to the latter the safety is much increased. This solution absorbs all the ultra violet rays, and in this respect is much superior to glass. Howard Farmer who first recommended the light, designed a lamp of two glass cylinders, one smaller than the other and fitting into it so that a space of half an inch was left between the glasses, to be filled with the bichromate solution. This lamp mounted on a suitable base and furnished with a tight-fitting cover, had an electric bulb suspended in the inner cylinder. Instead of the two cylinders, a glass bowl could be filled with solution and the light immersed in it, provided the metallic fittings and the wires are waterproofed to prevent short circuiting of the current. Where some other kind of illuminant is used, requiring air for its combustion, a cell for the lamp front could be made and filled with the solution. This cell should allow for a thickness of about one inch of the liquid.

A Standard Light Many dark-room lanterns are fitted with a hood which hinges down over the glass. This may be depressed to shade the light from the eyes, while letting it fall on the developing dish. With the use of more, and safer light, the function of this hood passes. There should be some means of opening the lamp so that the naked white light is shown. It will be required for exposure when rapid development papers are being worked. But if it is to be used for this purpose the light should be as near a standard of brilliancy as possible. A gas or electric light may be kept fairly constant. With an oil light care should be used to always keep the light at one uniform height. The wick should be trimmed regularly, and frequently renewed.

The Door Having reviewed at some length these important items of ventilation and lighting, let us turn again to the general arrangement of the dark-room. The door needs some consideration. In a small dark-room such as we first referred to, the photographer would probably close and bolt his door after him, and if he needed to leave during development would cover his tray and leave his plate in darkness; but with a room which is regularly used, and in and out of which people may require to pass, some other arrangement is needed such as two doors with a sufficient space between them, so that a man may close one behind him before opening the other. Another way, preferable where people are constantly passing in and out, is to have no door at all, but a short passage, constructed with light traps, much on the principle of the ventilator indicated in Fig. 2. Wings are run about two-thirds of the way across the passage, alternately from the left and the right; these are colored dead black, and four of them will prove as efficient a light trap as is needed.

Shelves and Racks Racks to hold dishes are sometimes stored under the developing sink, but if the photographer prefers to sit at his work the space should be left clear, except for the escape pipe, and so leave room for his knees. If the sink is to be sat at it should be at a height of twenty-eight to thirty inches from the ground; for standing work some four to eight inches higher. A few shelves to hold bottles should be placed on the wall to right and left of the sink. The shelves should be used merely for solutions or apparatus.

The dark-room should not be a storage room for plates or paper, nor indeed for any chemicals except those which are in sealed bottles. Heat, fumes or damp may be as injurious to plates or paper as light. We have heard of a keg of hypo kept in one corner of a dark-room; but the handling of loose hypo in a dark-room leads to disaster in the shape of pinholes. Stock should be kept, and solutions which require heat should be mixed in some other place.

Measures and Dishes

The handiest measures for the dark-room are the tumbler-shaped ones. They are less liable to break than those running down to a point and standing on a flat glass foot. But they are of no use for measuring very small quantities of solution, and so one or two small-sized conical ones should be kept at hand, preferably the sort fitted with hard rubber bases. Dishes, at any rate in small sizes, are of porcelain, glass, papier-mâché, compressed fiber, hard rubber and tin. Porcelain is the most desirable despite its cost; it has the advantage of showing any dirt or stain, and thus conducing to cleanliness. Glass trays are, if anything, less liable to breakage than porcelain. Composition and metal trays are light and practically unbreakable; when they begin to look worn, or rust and leak, they should be thoroughly scrubbed in soap and hot water, and then coated inside and out with varnish or Probus.

Breakages

Breakages are supposed to be so common in the dark-room as to add appreciably to the cost of photography. This belief is probably an exaggerated one, but there is some ground for it. Possibly the real reason is to be found in the groping dimness of many rooms, where the feeble light has an effective range of only a few inches. If the room is reasonably lighted, breakages will decrease. Transparent glass is not easily visible in a dull light, and it is a good plan to paint a ring of white enamel round the top of graduates and trays. If the graduates are conical, paint a ring of white underneath the round foot as well.

Large Dishes Workers who use dishes in large sizes do not find porcelain or glass quite satisfactory. They are heavy to handle, which increases the tendency to breakage, and they are seldom quite flat, requiring an extra amount of developer to flood the plate. Many photographers resort to home-made dishes in large sizes; they are comparatively inexpensive and less liable to break with a sudden knock. A light wooden frame with a piece of glass for a bottom is a common form of dish; it has at least the advantage of being perfectly flat and requiring a minimum amount of developer. The glass pane may be replaced by a thin hardwood bottom, the whole of the tray inside and out being thrice coated with Probus or other waterproof paint. Serviceable trays for occasional use are sometimes lined with thin oilcloth. The tray should be waxed inside and out with paraffin, or the outside may be waterproofed with some other varnish. A paraffin candle supplies the wax, which should be melted and spread with a warm flat-iron. The oilcloth should be well flattened into the tray and then gone over with the warm iron. This will press it into position and melt the wax so that the rough side of the cloth adheres firmly to the box but not too firmly to allow it to be stripped when it needs renewal.

Dust A dark-room into which air and daylight can penetrate has great advantages. The window should be fitted with a screen which may be removed and the window opened when not in use. Dust in any shape is one of the greatest enemies of the photographer and a room which can be cleaned in daylight is less likely to harbor it than one which is perennially dark. The worst form of dust is the dust which arises from splashed chemicals after they have dried. Hypo is a notorious offender in this respect; if it drips from the plates to the floor or on a bench where it is not quickly mopped up, it will soon be ready to rise in a fine imperceptible powder—imperceptible until pinholes form on developing negatives.

Therefore, keep the dark-room cleaned by the regular use of a damp cloth, and be sure that any chemicals which are spilt spill only in the sink or on the lead-lined bench, and that these are carefully cleaned after every use. In the matter of dust half the battle is in prevention. There should be nothing in the dark-room which will either create or give lodgment to dust. The walls and the ceiling should be finished smoothly; and they should be varnished or coated with some waterproof, odor-resisting preservative paint, which will allow of a thorough sponging or washing.

Improvised Dark-Rooms

Comparatively few amateur photographers enjoy the convenience of a well-appointed dark-room. Makeshift substitutes, more or less inconvenient, are improvised in some spare corner of the house, or a room is temporarily adapted from its legitimate purpose. A great deal can, however, be done with very little dark-room facility, if the work is intelligently planned; and the work done need not suffer in quality. As development tends more and more towards automatic simplicity of manipulation, the need of apparatus is lessened and inconvenience will be minimized.

There is little that need be done in the dark-room beyond filling plate-holders and developing plates. The first is not a long operation and the second may be done now with a minimum of close attention. This helps to solve the two great difficulties of development in confined space. These are the lack of ventilation and working in front of a miserable light. Where these unpleasant conditions are present, the time of working may be minimized to get rid of the lack of ventilation, plates being covered during development so that the door may be left open. As for the lamp, it is well to realize at once that there is no need for a dull glimmer, even in a small room.

Changing Plates

To a certain extent changing plates is as delicate an operation as developing, as there is almost as much exposure to light when filling holders as when slipping a plate rapidly from a holder into the developer. But plates may easily be changed without light, merely by feeling.

First learn how plates are packed. It will be found that the plates of a brand are always packed in exactly the same way. The box of a dozen plates will contain two packages of six each or three of four each, and the plates are packed in pairs with the films facing.

Working in the dark, first open the box of unexposed plates and remove the packages from it. Then open the plate-holders, one by one, placing the exposed plates, film to film, in the bottom of the box—or they may be wrapped first in a piece of paper to hold them more compactly together. When the holders are empty fill them, replace the extra unexposed plates in the box, and the work is done. It is well to work with two, three or six holders so that they can always be changed from one box of a dozen plates, and so prevent the need of having two boxes open at once. And, before starting out to work, the holders should be filled and the spare plates all carried in full boxes, otherwise one of the boxes would always be only partly filled, giving the plates a chance to shake.

Away from Home

Persons traveling in Europe, and particularly in Britain, will find that many dealers and hotels provide a dark-room for the convenience of their customers. The use of this for changing plates is allowed for a nominal charge, or sometimes as a courtesy in consideration of plates or meals being purchased there. But often where no dark-room is available for tourists, the natural darkness of night will suffice. In a hotel—or any other—bedroom, if light does not shine into the room from the transom or from the windows, plates may be changed; or if a washing closet, or even a wardrobe is attached to the room a retreat may be made into it. If the light cannot be shut out entirely, a screen may sufficiently block it. If the work is expeditiously done, a slight amount of light is not fatal. Thus, moonlight shining on a blind will give quite a glimmer of light in a room, but will not affect plates exposed for just a few seconds.

A Changing Bag

The most satisfactory way of changing plates on tour is by means of a changing bag, a simple contrivance, usually home-made. This is a bag which for 4 x 5 plates should measure about 24 x 14 inches in size, made of two thicknesses of closely woven cloth, the inner one of which should preferably be red. To the center of each end is affixed a sleeve, some eight inches long, fitted with elastic, so that when the hand is inserted, the mouth of the sleeve clings snugly around the wrist. The sleeve—or one of them—must be large enough to allow a box of plates to be squeezed through it. If plates larger than 4 x 5 are used, one of the sleeves should be larger than the other for insertion of the box of plates, and it may be drawn tight at the wrist with a running tape, for an elastic which would stretch sufficiently to admit a box of 5 x 7 plates would be apt to sag around the wrist.

Procedure

Using a changing bag is a matter of feeling. Rest the bag on a table, on a wall, or sit resting it on the ground or on the knees, and put into it a box of plates and the plate-holders or magazine to be filled or changed, placing the plate-holders to the right and the box of plates to the left. Take the unexposed plates out of the box, placing them under it or in the lid. Then open the holders and transfer the plates from them to the empty box. Have the holders in a pile and slip the empty ones underneath. When all are empty refill with fresh plates. Place the balance of unexposed plates in the box, replace the lid and the work is done. Practice changing at home before setting out. Where the plates are changed in a magazine hand-camera or where they are placed in a developing tank, we need a larger bag and a larger opening. One side of the bag should be left as a mouth in which to insert the camera or tank, and should be made to fold over twice before buttoning tightly, to prevent any possibility of light leaking in. Bags are sometimes made with a small streak of ruby glass or celluloid let in as a window and a second strip to look through. A couple of loops to pass over the ears hold the strip to the eyes.

The Simplest Developing

Thanks to the convenience of packet or compressed developers, everything chemical required for emergency development may be carried, literallv, in a waistcoat pocket. A jug of water and a couple of trays, one for development and the other for fixing, complete the essentials. A candle placed so that its direct rays are shielded from the plate will give sufficient reflected light to work by, but not enough to fog the plate if it is immersed rapidly in the developer. A common plan and one which we have successfully used, is to place the candle under the table on which the plate is developed. First spread several sheets of newspaper on the table to absorb any spilt drops, pour the developer into—or mix it in—the dish, then place the candle under the table. Slip the plate rapidly from the holder to the dish, give the developer an even flow over it and cover the dish. Develop either a fixed time or fractionally; in the latter case an occasional momentary look at the plate is necessary until the image commences to appear. When development is complete, rinse the plate, and put it in hypo.

Washing After Fixing

The usual advice is to wash in running water to eliminate hypo. Fortunately this is not necessary, for half an hour's soaking—five minutes in each of six changes of water—will sufficiently cleanse a plate. And so, with a small dish and a quart of water we can remove the hypo.

Light

On another page we spoke unreservedly against the use of too small a lamp in the dark-room. But a collapsible lamp of ruby cloth, which folds into little space and opens out to hold a candle, may be useful. In a hotel bedroom, or other temporary room, where electric light is installed, one bulb only should be used and that one swathed in a couple of thicknesses of colored paper.

Another Simple Method

If a room can be sufficiently darkened — and usually it can at night — plates may be satisfactorily developed without trays. A safe light is essential, and a fair supply of water—running water if possible. Have a glass or bottle containing developer and another containing hypo. Mop over the plate with a swab of absorbent cotton dipped in water, and when the plate is wet all over take a second swab of cotton and quickly apply the developer in broad strips, using plenty of solution. By keeping the plate evenly moist—and safe as regards the light—it is quite feasible to develop thoroughly satisfactory negatives in this way. When the image is fully developed, wash the plate and fix by swabbing hypo in the same manner. While this method is perfectly practical it certainly is far from labor-saving, but may occasionally be useful in developing small plates while on journeys.

The Home Dark-room

The foregoing hints are useful in cases of emergency or when on tour, but much work is done at home, and here a dark-room is usually constructed or adapted. These home-made rooms may be divided into two kinds, some room such as a bathroom or kitchen, temporarily borrowed, or some unused room or corner turned into a permanent dark-room. Where people live in flats or the limited quarters often necessary in large cities the borrowed room is the rule; and this rule is either the bathroom or the kitchen, where water is on tap, and where it may be spilt with more or less impunity.

A Bathroom

If a bathroom or a kitchen be available they make a good dark-room for they have a supply of running water. A screen is needed to block the window; if the room is to be used by daylight this may be in part of non-actinic fabric; otherwise it may be made of wrapping-paper, or of paper pasted over a thickness of canvas. If there is a transom over the door it may have to be blocked; and a mat may be necessary across the bottom of the door; but usually at night the light-leakage around a door is negligible. A light screen of laths across two strips of wood will make a table to be placed over the bath, or wash-tub or sink. The strips of wood should be placed just far enough apart to fit snugly inside the edges of the bath, the laths projecting over far enough to rest on the edges. This will prevent any slipping of the table. The washing and hypo tanks may stand in the bath, but away from the developing table lest spilt solution fall into them; or they may be stood on the floor or a table, and the bath filled with water for rinsing plates, or used for the final washing.

Storage

Even in modest amateur work possessions accumulate. Unless we are content with one formula we multiply bottles, and perhaps trays, with every change. Development papers call for fresh supplies and other varieties of paper swell the list, both for developing and toning. Somewhere there must be a storeroom, large or small, according to individual requirements. A small cupboard fastened to a wall will suffice for modest needs. It is a good plan to have boxes to fit the shelves and to have the bottles required for any particular manipulation in one box which can then be carried to the dark-room. Storage is not a complicated matter, cupboard or shelf space taking little room. In theory, possessions may be kept down to a small minimum, but in practice they are very apt to grow. But a few shelves will hold a great amount of material. A narrow recess if it can be shelved from floor to ceiling—and strong home-built shelves are easily erected—will hold an extensive outfit. Negatives and books pack close, and bottles or packages, if methodically arranged, are almost as accommodating.

Portable Rooms and Cabinets

Portable dark-rooms may be obtained which open into a sort of a watchman's box, and collapse into a bulky but light package some six feet long. This mere reference should suffice for them, for it seems unlikely that a worker in this year of grace will ever carry one about with him, although models of all sizes and styles adorn the catalogues of many European dealers.

Essentials

The reader will have gathered ere this that the minimum essentials for a dark-room are few in number, and that modern advancement has tended to simplify manipulation. Many photographers can command neither a comfortable, permanent dark-room nor a bathroom and are driven to some makeshift in some obscure corner of the house. Here the arrangements may be more or less convenient according to force of circumstances. A safe light, and water, must be provided, also a sink or at least a shelf, and if possible, ventilation. These will be arranged, according to the size and shape of the available space. We reproduce from THE PHOTO-MINIATURE, No. 33, with acknowledgments to the *Photo Beacon*, a sketch of a dark-room made by boarding off the corner of a passage. This particular location was chosen because a water-pipe ran up the corner of the passage, and could easily be tapped. It will be noticed that there is no ventilation indicated, but this could be provided either by trap ventilators, or by boring a number of holes through or at the side of the door.

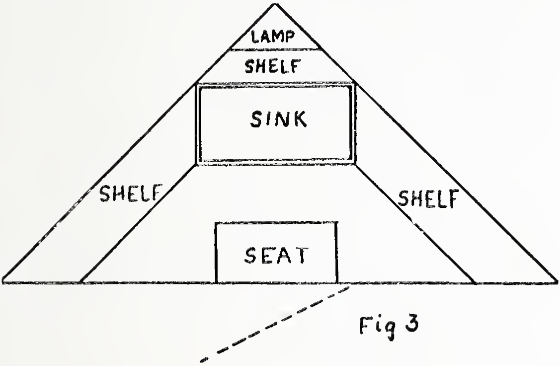

Fig 3

The Water-Supply

An adequate supply of water is the principal difficulty in the home dark-room, as there are few temporary or home-made rooms where a running supply can be installed. A method often recommended is to have a cask placed on a shelf, and from it a rubber tube fitted with a tap. When a stream of water is required the tap is turned on, and the waste-water passes into a second cask or tank. This would appear to be an unnecessary fitting in many cases, for it is usually mentioned in connection with washing plates. If the plates have to stand for half an hour in running water it means a heavy supply of water to be carried and poured into the reserve cask, and afterwards carried from the waste cask. And, if a number of plates are developed in succession, the stream must flow for a still longer time, should the plates be placed one by one in the washing tank, as they leave the hypo. A pail of water will furnish an "adequate" supply for most purposes. A jug with a good spout may be used to ladle the water from the pail as required. As the plates are taken from the hypo tank, let them be placed in a grooved washing box filled with water, and there allowed to soak. The water may occasionally be poured off and renewed; half an hour's soaking, with several changes of water, will eliminate the hypo as thoroughly as half an hour in running water.

Without a Sink

The suggestion of a cask and a rubber tube presupposes a sink, with escape to a second cask. But in many makeshift dark-rooms there is no sink. A sink has an auxiliary usefulness in catching drips or slops, for, working with shallow dishes, we are very liable to splash the developer, or let it drip from the negatives. Working without a sink means, chiefly, a little daintiness and care. If possible, the table used should be coated with waterproof varnish, or covered with thin oilcloth, and it should be temporarily covered with half a dozen thicknesses of newspaper. A jug of water to dilute the developer and a pail of water to rinse the negatives, with a second pail for waste will be required. Using a deep dish, and pouring developer to and from the dish carefully, the liquid spilled will be insufficient to soak the newspaper. After developing, the plates are rinsed by waving them for a few seconds in the pail of water, and after fixing, they are placed in the washing tank. Here they may remain until the last one is fixed, and then they may be further washed and dried away from the dark-room.

Portable Sinks

Portable furniture may be used where even a temporary dark-room is not available. The most common form is a folding cabinet fitted with a sink, with a cupboard for dishes and solutions, and with folding leaves to form tables. These are more common in Europe than in America; in this country the photographer who has to makeshift usually contrives to do so without using a rather cumbrous piece of furniture. Measurements need not be given, for exact construction will depend on individual needs or ingenuity. It consists of a small packing-case, mounted on legs, with a sink placed on the top, a folding wing at one side and fitted inside with a rack for dishes and a space for bottles. A jug or pail of water, and a pail for waste will be needed. The sink may be lead-lined—or a large shallow oven tin may be used—or it may be made of closely jointed wood, well waterproofed. A simpler plan would be to have a shallow sink to stand on a table, and keep the trays and bottles in a separate box. The developing cabinet is cumbrous to handle, and will require room for its storage when not in use.

Enough has been said to show that the minimum requirements for a dark-room are few in number. The two keys to successful work are simplicity and strict cleanliness. The requisite furnishings are few in number. A few developing dishes will be needed—one will suffice as a minimum,—and should be deep rather than shallow. A fixing bath and washing box of suitable size; a few drying racks; several large and one or two small graduates complete the essentials. A balance for weighing chemicals, an enameled pan for heating solutions and a few glass stirring rods and a funnel will be needed when solutions are made up, but these may advantageously be kept in another room.

These are minimum requirements, and the photographer who is fond of experimenting will find his possessions increase. But with a nucleus to commence from, the increase will come gradually with widening experience and can be automatically grafted on the first beginnings.

Making a Needle-Hole

BY DR. EDWARD GRAY

This note is designed to be supplementary to Nos. 27 and 70 of THE PHOTO-MINIATURE and records the process which has yielded the best results in my hands. Success in making a needle-hole depending upon close attention to details, no apology seems necessary for the minutiæ here given.

The implements needed are: a stout needle; two other needles, say Nos. 11 and 12, each of the three mounted in a wooden handle; a small file (about ¼ inch broad) also provided with a handle; one, or, better, two dental bur-drills, a smaller and a larger; a piece of slate-pencil ground off at a considerable angle; a light hammer, such as a tack-hammer; a pocket-lens of about 15 diameters' magnifying power; and some means of measuring minute quantities between the $\frac{1}{100}$ and the $\frac{1}{25}$ of an inch. A special paragraph will be given to this last specification.

A single needle-hole may be prepared at one time (as for the ordinary style of camera); but if the amateur is preparing for stereoscopic exposures—as is desirable—and particularly if he is likewise providing a substitute for the rising-front, it is advisable to work a set of four at one time in the same strip of metal. It is highly desirable to have four sizes of needle-holes (the so-called pinholes) and as they are not commercially obtainable in graded sizes the user must needs prepare them himself. The novice should understand that the requisite qualities of a good needle-hole are: that it shall be quite round; of a definite size; its edges shall be extremely thin; these edges must not reflect light; and the sides must slope at a wide angle.

How shall all these requisites be secured? The process worked out by the writer is as follows: A strip of brass one inch broad and of convenient thinness (mine was $\frac{1}{90}$ inch, obtained from a band such as is put around the magnesia covering of a steam-pipe) is smoothed and cleaned and one-square inch marked off into four half-inch squares or (as the case may be) a single square of ⅝ inch laid out. The center of each is carefully found and the strip laid upon a smooth board or a plate of lead with or without a strip of paper between. Apply now, carefully, a wire nail with a moderately blunt point —one about 1½ inch long will serve well—to the center of the square you are about to work at in a vertical direction. Tap it gently with the little hammer; if the size is to be very small let the blow be a very gentle one. Turn over the strip and a minute boss will appear. With the file—or a fine stone—slowly and carefully reduce this to the level. When accomplished, the resulting circle should not exceed the one-sixteenth or perhaps one-fifteenth inch in diameter. If greater the needle-hole will fail except for the largest sizes. You have now a depression where the metal is but one-third to one-fifth of its former thickness. Take now the dental bur and carefully ream out a conical well, not too deep and stopping short of producing a new minute boss on the back. Now, with the stout needle press in the center of the conical well until you feel the point just go through. If you are trying to make a one-quarter millimeter (or No. 5) hole put a piece of paper on a glass for a backing in place of a strip of wood. Turn over the strip of metal, examine the bur with the lens and dipping your piece of slate-pencil in water gradually grind down the raised edges of the bur to the level. This done, turn back the plate and now begin to work with the needle proper to yield the size of the aperture desired, pressing but a very little at a time. When a perceptible bur is made on the back, grind down again with the slate-pencil and water. Continue the widening of the hole, turning the needle therein until the exact diameter is just reached. Make sure that no bur projecting beyond the level remains on the back. With the lens examine the edges of the aperture obliquely. If these approach the form of a short tunnel, in any degree, apply the bur-drill (in front), stopping short of getting an edge so thin that it will bulge. A thinness of $\frac{1}{1500}$ inch is easily attained. Blow away or dust off with a camel's-hair brush any brass cuttings. The mechanical part is now finished and the little plate presents its best appearance to the eye.

Repeat the process for the other holes of the set then with metal shears cut off the four in one piece. It is particularly desirable to work the stereo apertures thus close together (for comparison) before cutting apart.

The final step is now at hand, namely the blackening. Exposure to burning sulphur has been unsuccessful in my hands and blackening with soot is too fugitive. The best chemical means which I have found up to the present is as follows: Take about a teaspoonful of dilute hydrochloric acid (U. S. P.) and add to it an ounce or ounce and a half of water. A glass container is desirable. Into this put two fragments of sodium hyposulphite, each about the size of a pea. Place the set of needle-holes in the solution and gently agitate. Sulphur is gradually thrown down and the brass turned a purplish color. Do not strive for black. In ten or twelve minutes' time (adding another fragment of hypo if you wish), remove the plate with forceps, not with the finger. Drain and dry off about two inches above an alcohol flame. When cool examine the back with the lens. The edge of the aperture will no longer reflect light. Cut apart the set of four and mount each in suitably thin paper with a central aperture of about $\frac{3}{16}$ inch. Your work is now ready for attaching to your camera and testing in practice.

A method for obtaining a thin plate of bronze by annealing and rolling out a one-cent coin is described by my friend, Mr. Henry P. Bowie (not Bowè, as in PHOTO-MINIATURE No. 70), but lack of ready means to accomplish such work—in my present isolated station—has thus far precluded me from testing this method. A plate so thin as $\frac{1}{350}$ inch would seem moreover to be difficult to preserve in a plane surface. Still I hope to test the process before long.

For the measurement of the thickness of the metal strip and of the needle used I have had recourse to the "Cover-glass gauge" manufactured by the Bausch and Lomb Optical Company, and should be at a loss to know how to proceed without this or an eye-piece micrometer used in the microscope. I have no personal knowledge whether a Brown and Sharpe wire-gauge could be applied for the purpose and must leave the solution of this problem to the curious reader.

Finally, I can not too strongly commend to the maker of a needle-hole to disregard entirely the trade numbers of needles (which vary with different makers) and to adopt the sizes and numbers of Dr. D'Arcy Power (PHOTO-MINIATURE No. 70), namely: No. 1, 1 millimeter; No. 2, 0.75 mm.; No. 3, 0.5 mm.; No. 4, 0.375 mm.; No. 5, 0.25 mm.; the reason being that these simple cardinal numbers multiplied by the plate-distance in inches give the *f*/ value of the aperture used when minutes are read in place of seconds or hours in place of minutes; otherwise there is no guide to the proper exposure except a set of complicated tables, and those in THE PHOTO-MINIATURE No. 27 give much too long an exposure, at least for use in California. Thus, the one-half millimeter aperture, No. 3, used with the plate at 5½ inches gives 3 x 5½ = 16½, practically *f*/16. If now the indicated time for *f*/16 with the plate used is $\frac{1}{12}$ second, then for this needle-hole it is $\frac{1}{12}$ minute or 5 seconds. If the time by exposure-table were 30 seconds then for the needle-hole by same light it is one-half hour. Personally, also, I like a size intermediate between Nos. 2 and 3, 0.625 millimeter (or $\frac{1}{40}$ inch), numbered 2½. I should hardly venture to use No. 1, unless with a large plate.

To recapitulate: the essentials of the process are thin metal (brass, bronze or copper); a few needles, one stout, in handles; a dental bur-drill; a slate-pencil, and either a small file or a water-stone for removing the first bur. Lastly, some trustworthy method of overcoming reflection from the edges of the aperture. Such reflection is the chief cause of blurring or woolliness of the image. An aperture prepared as here described should be a joy to its possessor.

Notes and Comment

Color photography with the Lumière Autochrome plate continues to absorb the attention of European photographers. At an exhibition of the results secured by Mr. R. Child Bayley at the rooms of the L. and P. Photographic Association, Mr. Leslie Clift said that the plates surpassed in fidelity of color rendering the best results of the cleverest three-color workers, in which matter Mr. Clift can be regarded as an authority. At the same meeting a plate was put in the lantern and an image enlarged to four feet diameter was thrown upon the screen, to the enthusiastic satisfaction of all present. Another critic testified that he had seen in Paris a reproduction of a Persian carpet by the method and could imagine no more perfect rendering of color. Mr. F. T. Beeson, of Messrs. Newnes, Ltd., also speaks from his experience with the new plates as opening up undreamt-of possibilities in the copying of paintings and other colored originals for photo-mechanical reproduction in color. Mr. Alfred Stieglitz says: "The possibilities of the process seem to be unlimited. All who see the results achieved by Mr. Steichen are amazed at the remarkably truthful color rendering; the wonderful luminosity of the shadows, that bugbear of the photographer in monochrome; the endless range of greys; the richness of the deep colors." Experiments have shown that Autochrome lantern slides will eventually supersede the hand-colored slides now universally used. Working with a brilliant light, M. Dillaye has secured portraits on Autochrome plates in the studio, using a lens working at *f*/5 with an exposure of five seconds. Other prominent workers in various parts of Britain and France have told of their success with the plates, and a special section of the exhibition of the Royal Photographic Society, now open in London, is devoted to the work of these first experimenters. Quite a number of European photographers seem to have secured small supplies of Autochrome plates despite their scarcity, but we can get no definite information as to the date when they will be available to American workers, or when specimens will be publicly shown in this country. From a letter in the "Photographer" of a week ago, we gather that the Lumière Company, at Burlington, Vt., is experimenting with the plates with complete success.

❧

A rival to the Lumière Autochrome plate is announced already,—the Omnicolore—made by Jougla, of Paris. It is promised that this plate will be on the market "shortly."

❧

The C. P. Goerz Silver Trophy, which has been the object of strenuous competition among professional photographers for the past three or four years, was this year won for the third time in succession by J. H. Garo, of Boston, and so becomes his property. The competition aroused the keenest interest in the profession and the C. P. Goerz Company deserve much praise for their generous enterprise in offering so valuable an incentive in the improvement of American professional portraiture. The portrait which secured the cup for Mr. Garo is a remarkably clever bit of work and shows a steady advance upon his work in past years.

❧

Those who are looking for something novel on printing papers for the exploiting of their summer negatives should try the Tintona papers imported by J. F. Lewis, 379 Sixth Avenue, New York. These are print-out papers with the emulsion coated on colored bases, such as cream crayon, faint blue, green and steel-gray, the tint of the paper giving very desirable effects with subjects carefully chosen for the particular tinted base employed. The Tintona Series is one of an extensive line of papers made by the Leto Photographic Material Company, of London, for whose products this firm has secured the American agency. The sepia prints we made a few days ago on Tintona cream crayon by simply fixing in hypo are all that the heart of man could desire.

◆

The Second New York Aristo School, held under the auspices of George Murphy, Inc., at 57 East Ninth Street, New York, last week, drew a large attendance of photographers from the galleries of the city and nearby towns. Among the many interesting processes and working methods demonstrated, the demonstrations of Ozobrome were followed with great interest, and there can be little doubt but that Ozobrome will quickly become one of the most popular of our printing methods. The work of the School was wholly practical and must prove of great benefit to all who attended.

◆

We are advised by Mr. Alfred Stieglitz that the Third Series of Exhibitions held at the Little Galleries of the Photo Secession will be opened in November next with the Annual Exhibition of work by members of the Photo Secession. Readers of the magazine visiting New York during the winter should not fail to take advantage of these opportunities to see selected examples of pictorial photography. The above exhibition will be followed by others at intervals, presenting collections of foreign and domestic pictures, not necessarily photographic. It is to be hoped that Mr. Stieglitz will be persuaded to make room for an exhibition of examples of color photography by the Lumière method, in the success of which Mr. Steichen and he have been actively interested during the summer.

◆

Recalling the widespread interest and enthusiasm aroused here and in England by the successful outcome of the Lumière method of color photography, it is passing strange that so far neither the London nor the New York branch of the Lumière Company has made any public announcement concerning the process or the plates essential in its manipulation.

Books and Prints

All books noticed in these pages may be ordered from the publishers of THE PHOTO-MINIATURE and will be promptly forwarded postpaid to any address on receipt of the publishers' prices as here given.

Finishing the Negative. A Handbook to the Processes between Fixing and Printing. Second edition, revised and edited by H. Snowden Ward. London: Dawbarn & Ward Ltd.; New York: Tennant & Ward. Paper covers, 50 cents.

This encyclopedic textbook, formerly issued in cloth binding at $1.25, is now republished in the well-known "Band of Blue" series at a price which puts it within the reach of every amateur and professional. It is a careful and comprehensive compilation, giving a mass of reliable formulæ and working instructions for the manipulative branches mentioned in its title.

❧

Studies in Sensitometry. By Robert James Wallace. I: The Daylight Sensitometry of Photographic Plates and a Suggested Standard Dispersion-piece. University of Chicago Press.

In this monograph, reprinted from the "Astrophysical Journal" for March 1907, Mr. Wallace makes a convincing plea for the use of his replica grating as a standard dispersion-piece for investigative work in sensitometry, and describes a simple form of spectrograph suited to its use, giving a method of daylight sensitometry based on the photo-chemical investigations of Hurter and Driffield. This method is advanced as a practical, everyday means of arriving at reliably comparable results suited to the requirements of the general worker in photography as well as the scientist, i. e., a method for users of plates rather than for plate makers. Incidentally, the author calls attention to the great value of the work of Hurter and Driffield and the later researches of Sheppard and Mees in this field. The paper, which should be read with the author's earlier monograph on "Diffraction Grating Replicas" at hand for reference, is extremely suggestive and should not be overlooked by those interested in the progress of sensitometry.

⁂

Art and the Camera. By Anthony Guest. 158 pp. profusely illustrated. London: Bell & Sons; New York: The Macmillan Company. Net $2. Postage 20 cents.

This welcome addition to photographic literature, by a writer comparatively unknown to American readers, is not a textbook, but a collection of about fifty short essays on various phases of pictorial photography, with as many halftone illustrations by more or less well-known pictorialists. The charm of the book lies largely in the author's style and the freshness of his point of view. The topics discussed include: "Is Photography an Art?", "Study of Values," "Aërial Perspective," "Composition," "Balance," "Decorative Arrangement," "What to Leave Out," etc.

⁂

Among Bavarian Inns. By Frank Roy Fraprie. 336 pp. Illustrated. Boston: L. C. Page & Co. $2.

We have read this little book with keen enjoyment. It is an interestingly written record of a summer sojourn in the Bavarian Highlands, with word pictures of the life in and out of the ancient Bavarian cities and villages—Munich, Oberammergau, Partenkirchen, Mittenwald, Innsbruck, Augsburg and Nuremberg. The illustrations add to the attractiveness of the book and suggest a wealth of pictorial possibilities to the amateur seeking fresh fields and pastures new for the summer of 1908.

⁂

The Bulletin of Photography. A Weekly Magazine for the Professional Photographer. Edited by John Bartlett and A. D. Silliman. Published by Frank V. Chambers, 606 Sansom Street, Philadelphia. Subscription, $1 per year.

The success attained by Mr. Abel's "Photographer" was bound to bring forth competition, and it has arrived in the "Bulletin," which promises to be a lively paper, well calculated to keep the professional worker right up to date in business matters and practical methods. The issue dated August 21, just received, is largely occupied by a report of the proceedings of the National Convention recently held at Dayton, Ohio. We hope that in some future issue Editor Bartlett will second the efforts of the Editor of the "Photographer" to inaugurate a drastic reform in the management of the National Association, a reform urgently necessary and for which the times are ripe.

❧

Hints on the Selection of Zeiss Objectives. By Dr. Paul Rudolph. Fifth edition, revised and enlarged. Gratis on application to E. B. Meyrowitz, 104 East 23d St., New York.

This very useful little book about lenses, from which we have gathered much valuable information in years past, appears in a revised and enlarged edition for English readers. Although published as an advertisement of the lenses manufactured by the firm of Carl Zeiss, at Jena, its information is applicable to lenses in general, and it affords practical help in the choice of lenses for different classes of work. The copy on our bookshelf is more often consulted for reference than many other works on lenses which we possess.

❧

Lloyd's Photographic Encyclopedia 1907 has just been issued by Andrew J. Lloyd Company, 313–319 Washington Street, Boston. Like its famous predecessors, it is a complete reference book of photographic apparatus and specialties, including much useful information on photographic manipulation, tables, formulæ and a good list of textbooks in all branches of photography. Readers of THE PHOTO-MINIATURE can obtain copies of the book by mentioning this magazine when they write, which they will do well to do as soon as they see this notice, as the "Encyclopedia" quickly goes "out of print" because of the great demand for it.

❧

A beautiful catalogue is the new list just published by the Folmer & Schwing Co., of Rochester, N. Y., describing the complete Graflex line of cameras and focal-plane shutters. The new Press Graflex, the wonderful 3A Graflex, and the Naturalists' Graflex are fully shown in detail, with a number of interesting illustrations by Mr. Alfred Stieglitz and other well-known workers. Every one interested in the possibilities of modern photography should get this list and give it a careful reading.

❧

The catalogues published from time to time by Messrs. Hirsch & Kaiser, 1757 Fillmore Street, San Francisco, have always been notable for their common-sense arrangement and typographical beauty. The 1907 catalogue, recently issued, well sustains this reputation, listing all the staples and specialities carried by the firm, with a profusion of carefully printed illustrations. Western readers should not overlook the splendid facilities and service offered by this house. A copy of the catalogue can be had by sending a post-card to Hirsch & Kaiser, mentioning this magazine.

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The Amateur Photographer

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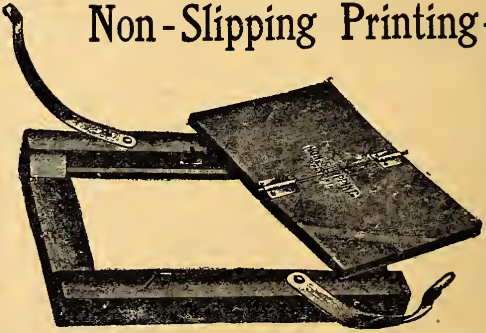

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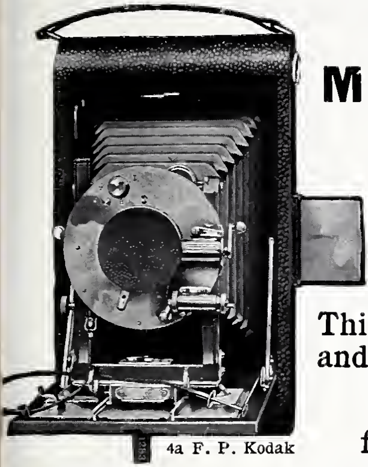

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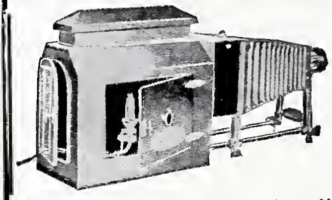

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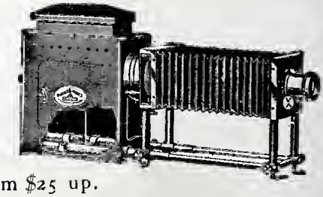

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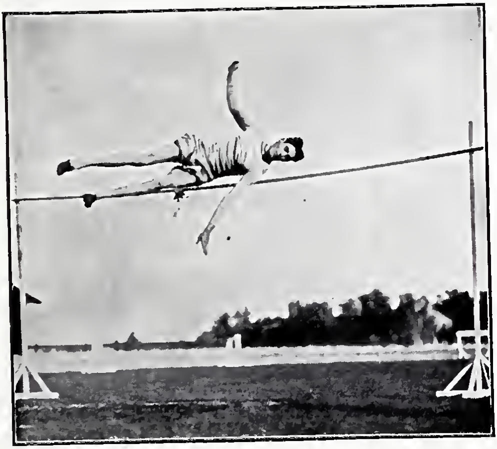

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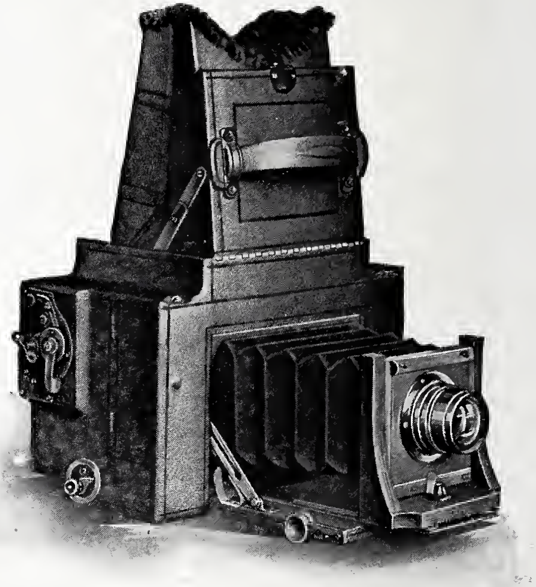

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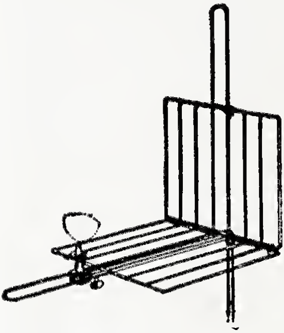

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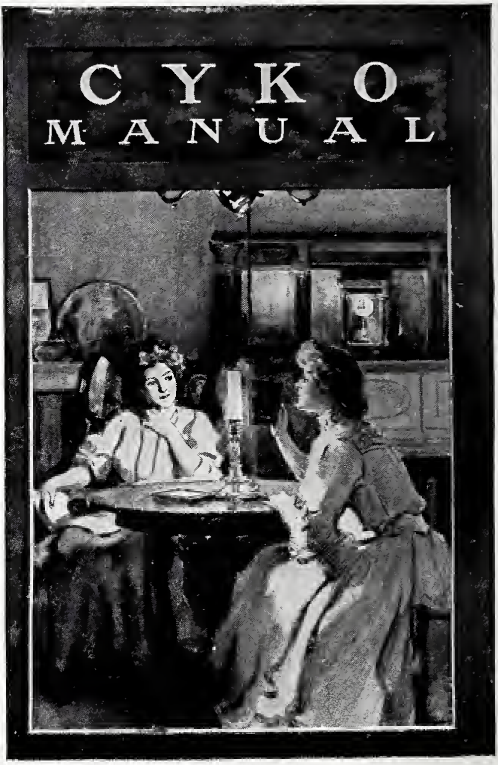

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W. H. Wallace

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James Thomson

The brook in winter
Thomas A. Morgan

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The Photo-Miniature

A Magazine of Photographic Information

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Volume VII NOVEMBER, 1907 Number 83

Coloring Lantern Slides

Considering the widespread use of the optical lantern in the illustration of public lectures, educational work and home entertainment, one notes with surprise how few of the countless lantern slides shown year after year are colored, or make any attempt to suggest the the colors of the objects or scenes they reproduce. Possibly, in educational work on a large scale, such as the Public Lecture System operated during the winter months in New York and other large cities, the lack of color results from a necessary economy. In other cases, the feeling that a good plain or uncolored slide is altogether preferable to an indifferently colored slide has its influence against the use of colored slides of any sort. To this feeling, also, may be due the increasing popularity of the "toned" lantern slide, i. e., a slide which, by modifications in development or the use of chemical solutions or dyes, is given a red, brown, blue or green tone, as more agreeable for its particular subiect than the normal black color of the ordinary photographic slide. Apart from economy and the general prejudice against poorly colored slides, the principal reason for the preponderance of plain slides in our lantern exhibitions is the belief that the coloring of a lantern slide is a work of some difficulty, beyond the ability of the average worker in photography. The purpose of this little book is to disabuse the reader of this erroneous belief, and to give him a working knowledge of several reliable methods, by means of which, with a very little patience and practice, he may add to his lantern slides the incomparable charm of color. Incidentally, those who are seeking a profitable speciality for home work will find in these methods a fairly easy means of making money in spare time, simply because the demand for expert lantern-slide coloring is greater than the present supply, a condition which is hardly likely to change until some direct color process similar to that now being introduced by the Lumière Company becomes everywhere available at a moderate outlay.

With the assurance that the methods herein advised are not at all formidable to the reader possessed of ordinary patience and an average appreciation of color, let us first consider the so-called difficulties which deter so many workers from attempting the coloring of lantern slides. In common with all methods of painting, lantern-slide coloring requires a special equipment or "lay-out" of colors, brushes and a few tools. A very small outfit, however, will suffice for a successful beginning, and can be provided at a nominal cost. Similarly, it is desirable to provide a suitable working place: a good light, a table and chair chosen for convenience and comfort in working, with a room or corner free from rug, curtain or other draperies likely to supply dust. Finally, in the work itself, half the beginner's difficulties vanish with the knowledge that the successful coloring of a lantern slide does not mean the covering of each and every detail in the slide with just the right touch of color, but, in ninety-nine slides out of a hundred, simply an acceptable suggestion of the colors of the object or scene secured by "washes" of color and a few after touches of color to accentuate the form and color of prominent features and details. Of course, in the coloring of slides showing individual flowers and in technical work, such as anatomical slide coloring, the work more closely approaches miniature painting in exactness and precision; but this kind of work need not trouble the beginner, whose range of subjects rarely goes beyond landscapes, general views, street scenes, sunset and moonlight effects, an occasional portrait or genre, and similar familiar objects of everyday life. For these the "suggestive" treatment is amply sufficient, with such extras and refinements as his increasing skill will suggest from time to time. So much for the fancied difficulties. What are the real difficulties?

To the beginner in lantern-slide coloring with oil colors who has no previous knowledge of the handling or manipulation of oil or varnish paints, with the necessary media, such as copal varnish, megilp, japanners' gold size, Robertson's Medium, and similar preparations, turpentine, etc., the first difficulty will be to acquire the handling of these in a cleanly and workmanlike way. This is simply a matter of becoming familiar with new materials; such as one must expect in taking up any new artcraft. Those who already possess some familiarity with the handling of colors in china- or glass-painting will, of course, find no special difficulties in the manipulation of the colors used in lantern-slide work. Then there is the minor difficulty of preparing the gelatine or collodion surface of the slide so that it will "take" the colors smoothly and permit the necessary manipulation required in obtaining the desired effects. Finally, there is required a certain amount of patience and practice in mastering the use of one's brushes, stomps, and the art of "dabbing" or "fingering" as it is called, by which the colors are evenly distributed or blended as may be required. This again is simply a matter of becoming familiar with the skilful use of one's tools, essential in all the arts. In some coloring methods, such as the simple tinting of slides with dyes or commercial color preparations, the difficulties peculiar to the use of oil, varnish or water-colors do not exist; but the finest of colored slides are almost invariably made by methods involving the use of oil-colors and the necessary skill in their proper manipulation. The choice of methods, however, must be left to the reader, who will quickly form his own standard of excellence and determine for himself just how much personal care and effort he will devote to the attainment of his end.

The first thing to be learned is to be able to look at the subject of a slide from the colorist's point of view. It is obvious that all subjects are not suited for coloring, the normal warm gray of the photographic image being better suited to the proper rendering of the character of the subject than any mixture of colors we could apply.

Statuary, for example, seldom requires color, although at times a suggestion of color in the background may enhance the effectiveness of the slide when viewed on the screen. Similarly, architectural details, sculptured tombs in cathedral churches, fonts, and sometimes whole exteriors of ancient stone churches, technical subjects, such as parts of machines, carvings, and some interiors, are often most effectively rendered in the plain, uncolored slide. In the same way should be acquired the ability to judge whether a subject requires much or little color, and whether the treatment should be broad in character or carefully worked in detail. With this cultivation of the color sense will come the fine judgment which decides whether the subject requires warmth or coldness of effect in its coloring, this depending not only on the character of the subject itself, but also upon its illumination as determined by the time of day and the season when the view was made. So, too, we must learn to recognize the continually changing aspects of colors under the influence of light and shadow, of use and wear and tear. Especially must we keep in mind the fact that the charm of color to the cultivated eye lies most largely in gradation, this being in fact to color all that curvature is to lines, as Ruskin aptly expressed it. Thus he says: "The victorious beauty of the rose as compared with other flowers depends wholly on the delicacy and quantity of its color gradations, all other flowers being either less rich in gradations, not having as many folds of leaf, or less tender, being patched and veined instead of flushed."

The technical quality of the slide selected for coloring is a detail which needs attention. All lantern slides are produced either by the "wet collodion" process, favored by makers of commercial slides because of its simplicity and cheapness, or with ordinary or special gelatine dry plates,—the latter being generally used by amateurs and others who make their own slides. Both kinds are equally adapted for coloring, but it is necessary to know by which method the slide was made before attempting to color it, as the preliminary treatment of the slide differs in each case.

The sort of slide best suited for coloring is one with barely visible detail in the highest lights of the picture and with transparent shadows, without heavy density or thickness in any portion. The image should preferably be of a silvery gray color, and the sky portion quite clear, without any veiling. It goes without saying that the slide should be brilliant without hardness: in fact, the more we combine richness of gradation with brilliancy in the slide, the better will the effect be when colored and projected on the screen. These qualities are most easily secured in "wet plate" slides, but some of the finest colored slides I have seen were made on "gelatine" plates, such as the Seed, Imperial and Barnet C. G. lantern-slide plates. These, as far as manipulation goes, are well within the capabilities of the average amateur. "Wet plate" slides must be coated with a medium before coloring, such as a weak gelatine solution. With "gelatine" slides, the different developers and fixing baths used sometimes cause the film to be repellent of the colors used. In such cases either a special medium is used, suited to the colors employed, or the slide is simply treated with a 5 per cent solution of formaldehyde. Particular care should be taken to insure that the slide to be colored is thoroughly free from any trace of hypo-soda, as this will give a disagreeable tinge to the colors and add to the beginner's difficulties. Going on the theory that prevention is better than cure, it will be profitable to glance at a few of the chief causes of failure applicable to all the various methods used for coloring lantern slides. The recital of these in the beginning should not discourage the beginner, since to be forewarned is to be forearmed.

Beware of excess of color. Brilliancy depends largely on preserving the transparency of the slide, and the use of too much color tends to darken the slide and render it more or less opaque.

As a rule, the beginner in lantern-slide coloring is apt to use crude or too bright colors, obtaining in consequence harsh and inharmonious contrasts of vivid colors, displeasing to the cultivated eye. It is better to err on the other side and use the softer shades of color, using repeated applications of weak color until the desired effect is gained.

Carelessness in following the outlines in a subject is a frequent cause of dissatisfaction. It should not be forgotten that a line no thicker than a hair in the slide will appear as thick as a stout rope or cable on the lantern screen. Precision in touch, a steady hand, care and patience are necessary, but are easily acquired if the worker is really interested in results. A good light is half the battle. Some workers prefer incandescent gaslight as most nearly approaching the light usually employed in projection; others advise a student's oil lamp as more agreeable to the eyes. Most slides, however, are colored by daylight, the colorist quickly learning to modify his coloring so that the colors will give the desired effect on the screen whether oil, incandescent gas, the oxy-hydrogen light or incandescent arc be used for their projection.

With this preliminary glimpse of the subject, we can now turn to the methods themselves, beginning with the use of transparent oil-colors as the standard and most widely favored method of today.

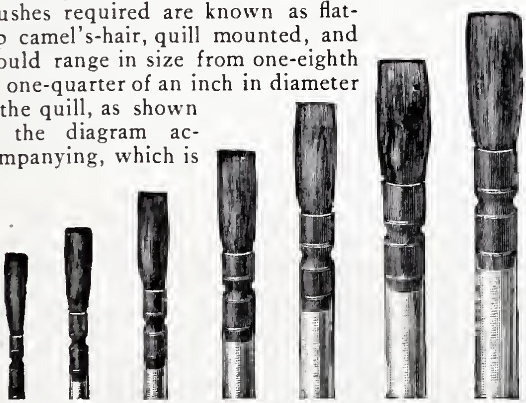
The Use of Transparent Oil-Colors

BY WILLIAM GREEN

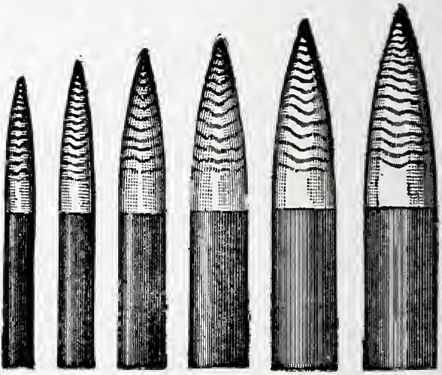
Although the majority of the colored lantern slides we see nowadays are colored with aniline dyes or water-colors prepared in various ways, few experts in this field will seriously question the superiority of transparent oil-colors over all other media where natural effects, the proper treatment of widely different subjects and artistic results are desired. The method requires a certain amount of skill and patience, but, once learned, is wonderfully elastic and adaptable, so that it is most favored by those who have a serious purpose in their work—professional colorists, etc. The method is not really difficult when once the first awkward preliminaries have been mastered; but, as far as my knowledge goes, there is no handbook which deals with the method in a practical way. In the following pages I will endeavor to provide this instruction in as simple a form as possible, with the hope that many of my readers may be tempted to try their hand at the method.

The materials and tools required for the method are few and readily obtainable. We need: Six or seven camel's-hair brushes—two of small size, two or three of medium size, and two of large size, all quill mounted; three artists' leather stumps of different sizes; one needle point; a brush rest; a working rest or retoucher's desk; a piece of opal glass, about 5 x 7 inches, on which to mix colors; three wide-mouth bottles with a capacity of about two ounces each; a small, wide-mouth jar or cup; several pieces of clean, soft rag, free from lint; one tube each of the following oil-colors: Crimson Lake (W. N.), Prussian Blue (W. N.), Ivory or Lamp Black (W. N.), Burnt Sienna (G. R.), and Italian Pink (G. R.); a hardwood stick about six inches long and pointed at one end; a piece of smooth pumice stone; half a pint of turpentine; two ounces of copal varnish, and a few brush sticks to fit the brushes selected.

The colors, brushes, varnish, turpentine and stumps can be purchased at any artists' supply store. The brushes required are known as flat-top camel's-hair, quill mounted, and should range in size from one-eighth to one-quarter of an inch in diameter at the quill, as shown in the diagram accompanying, which is



taken from the Devoe and Raynolds list. Select those only in which the hairs are all perfectly even, and which, when bent back against the thumb nail, spring back into position again quite easily. Pointed brushes are utterly unsuited for lantern-slide coloring, as they will not spread properly when charged with color. The quills of the brushes chosen should be soaked in warm water for a few minutes to soften them, and then firmly pushed on to the brush sticks previously provided in the required sizes. As the quills dry, they contract and so fasten themselves securely to the sticks.



The leather stumps, sizes as shown, should be very tightly rolled and quite hard when the center is pressed between the finger and thumb, or they will not clean off the color well.

The needle point is made by breaking an ordinary needle about one inch in length, holding it with a pair of pincers and pushing the blunt end into a piece of wood shaped like a pencil, about five inches long, the end with the needle being tapered as in sharpening a pencil. This is used for picking off any small pieces of lint, dirt or hair which may get on the surface of the slides during the process of coloring.

The brush rest can be cut from any piece of triangular-shaped wood about five inches long by ¾ inch high, having several notches cut at regular intervals in which to rest the brushes when not in use.

The working rest is made from a piece of hard, smooth wood about 13 inches long by 1¾ inches wide, ¾ inch thick, and has two wooden feet 1 inch in height to raise it from the table or working bench. If preferred, an ordinary photographer's retouching frame may be used instead, but I think better work can be done on the working rest as described.

The hardwood stick is used for picking out fine lines or other small detail in the slide that it is too difficult or tedious to avoid running over with color.

The clean, soft rag is for wiping the brushes after rinsing them in turpentine to free them from color.

Oil colors prepared by any reputable firm can be used for our purpose, but those made by Winsor and Newton, and George Rowney & Co., have proved the best in my hands. I have placed the initials W. N. and G. R. opposite the colors in my list, and these particular makes should be procured as each individual color works differently when it is made by different firms, but those recommended are extremely transparent.*

The oil-colors, as purchased, are not quite ready for use and require a medium to make them spread evenly over the slide, as well as to assist the drying and enhance the brilliancy of the coloring. For this we need two bottles of medium, known as "fat" and "thin." To prepare these, take two of the small bottles mentioned in the list of articles required and pour about half an ounce of the copal varnish into one and one ounce into the other, then add spirits of turpentine (which should be perfectly clean and bright) to each until the bottles are nearly full. Now take one of the bottles and, placing the ball of the thumb over the top to prevent spilling, shake vigorously for a few minutes until the varnish and turpentine are thoroughly mixed. Remove the hand and carefully wipe the mouth of the bottle to prevent the cork sticking. Do the same to the other solution and we have our medium ready for use. Get corks that fit rather easily and, before putting them into the bottles, cut a piece of wash leather to cover the cork and insure a tight fit. This makes it easier to remove the cork from the bottle and prevents pieces of cork from sticking to the neck of the bottle and getting into the medium.

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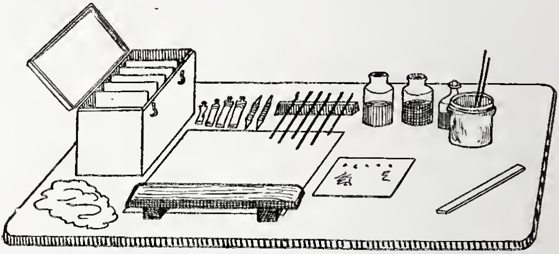
*The F. W. D. transparent oil-colors, class A, made by Devoe & Raynolds, New York, in the colors mentioned above, are practically identical in shade and working qualities with those advised, and may be more readily obtainable in some localities.—Ed. P. M.

The third bottle can be used for the remainder of the plain varnish which we shall require for such colors as yellow, scarlet, bright red, flesh-color, etc.

Preparing the Work-table

Having prepared the materials, we must take from our collection of lantern slides those we wish to color. These can be placed in a small negative drying-rack when not actually being painted or, preferably, in a grooved wooden box of the necessary width. A 3¼ x 4¼ negative box will answer very well if a piece of smooth wood about three-eighths inch thick is placed at the bottom of the box to prevent the slides dropping too low in the box. The box itself should be well brushed inside with a stiff brush and wiped out with a damp cloth to remove any trace of dust or dirt before use. As each color will take some time to dry, and dust is fatal, choose a room for painting that is covered with linoleum rather than carpet and having a window facing north. Place a small table close up to the window and arrange the brushes, paints, etc., as follows: At the side opposite the window lay a sheet of white matt paper about 8 x 10 inches to serve as a reflector. On the front of this place the working-rest; at the immediate right lay the piece of opal glass which should have been previously well cleaned; between the opal and the window stand the



three bottles with medium and varnish, having the one with "thin" medium on the left and that containing varnish at the right. A small cup or jar with some clean spirits of turpentine has a place at the extreme right of the opal, for washing the brushes, etc. The box or rack with the slides should be at the left of the table, and ranged along the edge near the window should be our brush-rest with the brushes, the needle point and hard-wood point; the leather stumps and tubes of color completing the layout, as shown in the diagram.

Preparing the Palette

A small quantity of color is squeezed out from each tube along the top of the opal glass in the following order, beginning at the left: blue, crimson, lake, sienna, Italian pink, and black. We can now with careful mixing of these make every shade of color likely to be required.

Always replace the screw-cap of each tube after using, to prevent the color in the end of tube getting hard. Always squeeze the tubes from the bottom where they are folded, gradually rolling up the empty tube as the supply of color is exhausted; should you squeeze out more color than is required, give the tube a gentle squeeze in the opposite way, which creates a back suction drawing the color in again.

Selection of Subject

To properly understand the working of the different colors, I must ask you to imagine that we are about to color a landscape scene, such as is frequently found in almost every collection of photographs. I have selected this class of pictures for the first lesson as it is the easiest to color and lends itself to many different styles, producing quite a variety of effects. Before commencing our work I must impress upon you that the method of using oil colors for lantern-slide painting is entirely different from that used for painting on canvas. The colors used are fewer, as only those which are transparent may be employed. Everything seems so different and contrary to the usual procedure of building up the picture and adding the high-lights last, for in lantern-slide coloring you must remember that the illuminated screen is to supply the high-lights of the picture which must, therefore, be left as clear glass during the whole of the painting.

The best slides for painting are those with plenty of detail, and perfect gradation and of good strength without being too thin or dense, as a thin slide becomes buried in the color and looks patchy when finished; whilst a very dense slide destroys the color and looks unnatural, except for special subjects, which I will mention later.

The landscape slide I have selected is a rural scene including an old mill. In the foreground is a brook spanned by a fence, behind which stands the old mill with ivy growing in clusters over one end. Two tall trees are near the center of the picture, whilst to the right is an old tree stump standing by the road which leads to a bridge across the brook — beside the bridge a horse and cart are standing, the distance being light foliage, a clump of trees, etc.

Commencing to Color

It may have occurred to the reader that the selection of flat-topped camel's-hair brushes was a mistake for such small work as we have to do, but a little practice will demonstrate that it is not so; a good camel's-hair brush with plenty of spring in it will work out with color and medium into a flat, fan-shaped tool with perfectly smooth ends giving a wide spread of color. When the edge of the fan is used, a line of color as fine as a hair can be drawn without any difficulty, enabling the colorist by means of a slight turn, as the brush is drawn along the slide, to follow any curve or irregular outline. Similarly the extreme corners of the fan, when turned edgewise, can be used for painting the smallest circles and spots that will be necessary in any work you may be doing.

And now to start painting: Take one of the large brushes, dip it into the "thin" medium and work a little of the blue on the opal until you have a medium shade of color. Do not be afraid to work the medium well into the color, but do not make it too dark. Having worked the color well, brush evenly and quickly across the sky of the picture. You need not trouble about running over the trees and mill but keep the color a little lighter in the distance or lower part of the picture. Put down the brush and then with the tip of the second or third finger commence to press out the excess of color. This is called "fingering" or "dabbing" and is continued until the sky has an even appearance and all the grain of the finger disappears. Fingering is at first a somewhat tedious process and often difficult to master, but perseverance and repeated effort will bring success. If the grain of the finger is coarse, take the piece of pumice stone and, holding it under the faucet, allow the water to run and gently rub the tip of the finger until the skin is quite smooth. *Do not rub until the finger is sore.*

Fingering the sky in a slide

When dabbing the slide, it should be held with the left hand on the rest at an angle of 45 degrees. The dabbing is started at the sky-line and with rapid dabs gradually worked up to the top edge of the slide; the finger is then dipped into the turpentine, wiped quite dry on the clean rag, and the operation repeated until the sky is quite smooth, each successive fingering starting from right to left and vice versa, and then in an upward angular direction to ensure perfect gradation of the color. Keep the pressure of the finger-tip even during dabbing, or the sky will have some places lighter in color than others.

Defects in Fingering

If the color gets too dry and refuses to "finger," or the finger sticks to the surface of the slide as you are dabbing, your medium is too fat. Do not waste time if in this condition, but dip the corner of the rag in the turpentine and wash the whole of the color off. Wipe the slide carefully with a dry portion of the rag and commence over again, this time dipping your blue brush into the thin medium and then dipping the tip of the brush into the turpentine and working the color with this mixture. As different samples of copal varnish vary in consistency and become thicker more rapidly when left standing, it is difficult to give the exact proportion of dilution with turpentine for our purpose but practice will soon indicate whether the proportions given are correct or whether it will be necessary to dip the brush into the turpentine each time.

You can of course understand that you do not want too much varnish, or the color would never dry. If the brush is dipped too far into the turpentine making the color too thin, clean the brush thoroughly or dip it in the "fat" medium to correct.

Should the color not finger smoothly and show a white mottled circle with a dark spot of color where the finger has been, you have made the color too thin with medium and turpentine, and, although constant dabbing will eventually correct this, it is best to start over again with the medium a little "fatter."

The color and colorist are working properly when it takes about two minutes to finger the sky and when each successive touch with the finger smoothes the color without leaving a mark. When it is in this condition we can start fingering on any portion of the sky, which enables one to work in clouds with very little trouble, the dabbing being completed when the sky is an even blue without any grain of the finger showing.

The depth of color in the finished sky is regulated by the intensity of color first applied before dabbing.

Having mastered the fingering of the sky, do the same to any water in the picture and then proceed to clean off the color where it has run over in fingering. For this operation, take one of the leather stumps, and, having dipped the end into turpentine, wipe as dry as possible with the rag, using a screwing motion in the direction in which the leather is rolled.

Commencing at the right-hand side of the slide, proceed to wipe off the superfluous color from the horse and cart, the distant trees and old mill, taking care not to run into the sky and make a white line. Then clean the stump by dipping in the turpentine, wiping with a twisting motion as before, and clean the blue off the grass around the brook and bridge. After this is done take the pointed stick and clean the blue from the two trees crossing the sky, also from the rails across the bridge over the brook.

Order of Coloring

Before proceeding with the next color, the reader will do well to note the order of coloring, which applies to all subjects. In lantern-slide work, the sky or background is always painted first; second, the ground and light stone work; next the purples or shadows are put in, then the greens, afterward the browns and blacks, finally the individual colors to complete.

Having finished with the blue, wash the brush in turpentine, wipe and put it on the brush-rest; if you have spread the color on the opal too much, clean with a piece of rag moistened with turpentine, and remember that the best work will be accomplished with as little spreading of color as possible.

If pieces of dirt or hair fall on the slide at any time whilst coloring, take them off with the needle point, or the color will have a tendency to dry in a ridge around them, which, when magnified and projected on the screen, look very bad.

The next part of the slide to paint is the ground or roadway leading to the bridge. To mix the proper color for this, use a medium-size brush, and having dipped the end in the "thin" medium, take a little burnt sienna, Italian pink, and a trace of crimson lake, working them together on the opal in such proportions that a sandy brown is made. This is brushed over the slide at the desired part, beginning under the horse or always at the most distant part, working the color a little darker in the foreground. When a color is mixed, you should just touch a clean portion of the opal, to see whether the shade is exactly as desired, as it is much easier to wipe a little color from the opal, than to keep cleaning off from the slide with the leather stump.

Having painted the foreground, wash the brush and, working the color a little yellower and much lighter, to make stone-color, use this for the mill, leaving the windows and roof for our next color, the light tree-trunks, as well as the railing of the bridge, are also tinted with the light stone-color.

The picture we are painting is not difficult and mainly flat colors without much shading will be used, so that we can get along with the next color, which I will call shadow-purple or gray; this is mixed with a very little blue and crimson lake, working it out with the "thin" medium.

I will not keep repeating the instruction to wash the brush, as it will be understood that this is necessary after every color in order to get clean results.

With the purple, which in tint should rather tend toward blue, we carefully paint the windows, also the left-hand side of the end of the mill, blending the color neatly into the stone-color previously applied; this is done to give solidity and roundness to the building and requires considerable practice to get the right shade and depth of color. The water under the bank is now strengthened with the same shade, after which a trace of black is mixed in to produce a slate-color with which the roof of the mill is painted.

The same color can be used for the man's coat. Having put in the sky, ground, stonework and purple we can next put in the green trees, and here the reader will find scope for all his or her appreciation of colors. There are so many different shades of green that it is impossible to give a name to each, but they are all made by mixing blue and yellow with occasionally a little black, brown or red, according to the nature of the subject.

The slide we are working on has practically one shade of green only, i. e., a bright and strong one made by mixing a liberal quantity of Italian pink (yellow) with a little blue, adding the blue gradually until the desired shade is secured, using the "fat" medium for mixing.

Brush the color on evenly, beginning at the left of the mill, taking care not to run over tree-trunks, ground or water and working the color a little deeper in the immediate foreground and on the ivy covering the mill. Color the foliage on the stunted tree at the right and, with the color worked out lighter on the opal, gently tint the straggling foliage on the two tall trees, then add a trace more blue to render the green a little darker and lightly paint the trees in the distance, being careful not to run over the sky.

Always remember that the more distant the green the lighter and bluer it will be, dying right off into purple where extreme distance or mountains are shown. With the green finished, you will begin to think from the appearance of the slide that your work is nearly completed; but this is not so, you have the two tall tree-trunks to shade with a mixture of sienna, red and black, worked up with "fat" medium and applied with a small brush, keeping the color a decided brown. The base of the stunted tree-stump is a darker and blacker brown made by working in a little more black, which color is also applied to the cart at the right and along the bottom edge of the bridge. The man's hat and trousers are painted black. Remember that a little black goes a long way, so use it sparingly, and with thin medium, always keeping in mind the fact that you are painting with transparent colors and want a certain quantity of light to pass through each when the slide is projected on the screen.

With the black our picture is finished as far as color is concerned, but, before finally putting it aside, look it over carefully and see whether you have run over the white woodwork of the bridge or fence around the ivy roots. These should have a little dark brown on them. If the colors run over, take the pointed stick and pick off the part mentioned, when you will have as natural and pretty a colored slide as any one could wish to see.

Other Subjects

Thus far I have treated only of the coloring of a simple subject. Those who have grasped the essentials of the treatment should find little difficulty in successfully applying the principles laid down, and can, with confidence, proceed to subjects demanding more care and skill. The range of subjects submitted for lantern-slide coloring is practically unlimited, but the principles followed in coloring are all displayed in the instructions given for the subject already treated. Different subjects, and the obtaining of special effects, however, require certain modifications in practice, and these we will now take up very briefly in order.

Skies

First we will take the sky. An ordinary plain blue was used in coloring our first picture, because the sky space was small; but supposing the sky to occupy half or more of the view, and that it is represented by perfectly clear glass in the plain slide, we can add to the effectiveness of the picture by introducing a suitable sky with clouds. This may be done as follows: Finger the blue on as before, but, before picking off the excess of color where not required, take one of the leather stumps, and, having moistened and wiped the tip, pick out from the blue sky a few fleecy clouds as nearly like those you see in the sky as you possibly can. Next gently dab along the lower edge of the cloud until it seems to blend right into the blue of the sky, and also let it die away at one end to get the proper atmospheric effect.

To do this successfully, the color must not be too "fat" or too "thin" when fingering, or you will never get a natural-looking cloud, but rather an effect as though you had cut pieces out of the sky and were looking through them into space.

Take care also that you do not make the clouds too large, keep them in proper proportion to the remainder of the view, and, whatever you do, do not get them all of the same shape or lighted from opposite sides. If there are any heavy shadows in any part of the view, use these as a guide for lighting your clouds.

If you desire to add a few purple or heavy clouds to your sky, you must let the blue get quite dry, or when you try to put another color on top of the first you will only leave a white mark wherever the brush touches. It will be obvious that this working in of clouds will need a little practice, and that it will be helpful if the reader has a few cloud pictures at hand to guide him to the reproduction of their forms and appearance.

Drying the Slides

In order to expedite the work of coloring, the slides should be baked or dried after the sky or first color is put on, so that any subsequent tints will work up better and to prevent the first color being removed.

The best and simplest way of drying colored slides is to get a sheet-iron baking oven, such as can be purchased at any department store for about $1, with two enameled iron trays to fit inside; or, better still, get two trays of thin sheet-iron made by a tinsmith that will just slide in the oven easily, the edges should be turned up about one-quarter of an inch all around to prevent the slides slipping off, but no solder must be used.

These trays should be of such a size that there is no great waste of space when laying the slides on them. An oven taking a tray about twelve inches square is a very convenient size, as you can get nine slides at once on each tray, so that if you are painting a number of slides you will not have to dry or bake each one separately.

To use the oven, stand it, with the trays inside, over an ordinary gas ring; have the gas fully alight until it is quite hot, then turn the gas half-way and taking one of the trays out lay your slide color side up on the tray, put them in the oven and, carefully closing the door to prevent dust falling on the color, leave them for five or ten minutes. *Great care should be used to close the door gently, as you will find it very difficult to remove any pieces of dirt that may get on them, after the slides are dry.*

To know when the slides are dry, remove the tray and lay it aside to cool. When cool enough to handle, take one of the slides with a leather stump wiped as for picking off, gently rub the blue at one of the extreme corners. If it does not remove the color the slide is dry; but if the stump makes a white mark put the tray back in the oven again for a few minutes, and try them again, repeating this operation until they are quite dry.

After some little experience, the colorist will be able to tell when the color is dry by the appearance or scratching with the finger nail. If the slides are left too long, the color will burn and turn a yellowish green.

I cannot dwell too strongly upon the importance and utility of the drying oven, as it is often desirable to dry some colors to work others over them in order to produce different effects, and, as it would take days for each color to dry spontaneously, there is no other alternative than to use the oven.

Sunsets and Moonlights

With this knowledge of coloring the plain blue sky and the addition of clouds, the reader may now try his hand at something more elaborate, such as the blending of yellow and red with the blue to produce sunrise or sunset effects.

Here, of course, the amount of artistic feeling possessed by the individual worker will have its influence on the results. To begin, select a slide with a good expanse of sky, taking a little crimson Lake and working it out very light with the "fat" medium brush a strip of color across the lower part of the sky. Then cover the rest of the space with blue, leaving the least possible bare glass between the colors. Now commence to blend the two colors, fingering across the join from left to right, then right as quickly as possible with a dragging movement, as you finger, so as to drag the red into the blue. Then finger the blue quickly, commencing on the join and working up into the blue. As soon as the blue is fingered quite smoothly, turn the slide upside down, and starting at the join again finger out the red until you have a perfect blend of pink going into blue. (Whenever you have any plain blue to finger, always work this first, as it dries very quickly whilst the red does not act in the same way). If the general appearance of the sky is satisfactory, now put in some clouds, following the instruction previously given. Should the slide have some natural clouds showing, try and keep these as prominent as possible when picking off with the leather stump. When the slide has been dried in the oven, the depth of red at the bottom of your sky-line can be increased if a deep sunset effect is required, or paint a bright crimson full- or half-circle to represent the setting sun.

When a deep sunset picture is being painted, keep all the subsequent colors a little redder in tone to lend a general warmth to the whole of the picture. To further increase the ruddy glow of sunset in the view, take a clean coverglass, which must not have any traces of grease on it, and finger a light tint of pink all over it, so that when the two are bound up together with a suitable mat between, the sunset will be as natural as possible.

If the effect to be produced is a sunrise, take a little Italian pink (yellow) and working this out with "fat" medium paint a strip of pale yellow at the bottom of the sky line, then a little pink, and finally the blue; finger the pink into the blue first, then the yellow into the red, pick off the excess of color, and keep the general tone of all subsequent colors slightly yellower.

If a moonlight effect is desired, commence in quite a different manner; first select only those slides that have good strong contrasts and prominent high lights, taking care that the direction of light is well to one side, and keep this in mind all the time this special slide is under color.

Decide upon the position of the moon in the sky and, taking a little pink, brush this lightly over the parts the rays from the moon would strike and also the foreground. Then mix up a good, strong shade of blue with "thin" medium and brush evenly over the whole of the slide, excepting the pink sections, on which you put a trace of blue only. Finger as usual, commencing each time you clean your finger on the pink parts and working them into the blue. Keep dabbing away until the whole is perfectly even and free from the grain of the finger. I should have mentioned before that the sky should be clear glass if you are going to put a moon in it, or it will not have the bright sparkle a moonlight picture should have.

When you have fingered the sky to your satisfaction, take the smallest leather stump and just make a small dot where you intend the moon to be, you then take the pointed stick and carefully clear away the color until you have as perfect a circle as you can possibly make. Do not make it too large or it will look absurd when magnified on the screen. A few clouds should now be worked in around the moon, picking off one edge firmly, and letting them die away gradually; finger these off very neatly, and you will be surprised at the effect produced.

With the moon as the centre, pick off nearly all the color from the bright parts of the picture, within an angle of 45,° gently soften the edges by fingering, and then with the pointed stick put a fine white line at the most prominent edge or high lights.

If the subject in hand has any foliage within the rays of the moon, tip the upper edge of the leaves with white. If it is a ruined castle or similar subject, pick out the tracery of the windows where the moon's rays fall, and also along the extreme edge of the ruin facing the light.

I might go on suggesting subjects for a long time and still not exhaust them all, but from those mentioned the reader can form a fairly good idea of what is necessary when putting in the moon's reflections. After the picking off is over the slide should be well baked, as the remainder of the coloring has to be done on top of the blue, and to rub any of the first color off with the brush would ruin the effect.

When quite dry, mix up a little stone-color as described in the earlier chapters and lightly tint the high-lights of stonework. If any ground color is wanted, mix this rather redder than you would for daylight views, then proceed to shade the whole picture. For this purpose mix red and blue until a good bluish purple is obtained; do not put it on too lightly, but wherever there is a heavy shadow in the photograph or where the moon would cast a shadow let the purple form the shadow, but do not obliterate the high-lights already put in.

Next put in the green (if any), using a decided blue-green made by mixing a little yellow with the blue. Do not forget, if any green is visible within the moon's rays, that this should be colored a little brighter than it appears in nature. Mix a good dark brown with black, red and a little sienna, using the "fat" medium. With this mixture paint any tree trunk, boughs, doors, rocks, and similar objects. Then take a little black only and touch the heaviest shadows to increase their depth of color; also put a very light touch of black in some of the clouds and soften by fingering; when this is done you should have a very effective moonlight scene.

A charming effect is produced by taking two slides of the same subject and and painting one a bright daylight and the other a nice moonlight, which will show you what wonderful effects can be produced with the same colors by different treatment.

Marine Subjects

Another class of subjects that appeals to a good many is that embracing the sea and all marine studies or waterscapes.

In this class some very choice pictorial slides are found; the heavy sea, breaking waves, surf, yachts, large ships, lake views with marvellous reflections and similar pictures can be most faithfully colored, the general treatment being the same as for others.

The sky is here the first consideration, then the water, and in painting this do not forget that deep water is a greenish blue, unless your view is one of the Italian lakes and then you cannot have the water too blue.

After the water and sky have been fingered and dried, paint the boats, etc., with the most natural color you can mix and shade up as previously described, shading the water with bluish purple and blue-green.

If the picture shows a stormy sea with heavy clouds, mix up a deep green for the water, a mixture of blue, black and red for the sky to make it look as heavy and dirty as possible; finger this well, bake in the oven and work on a little plain black to intensify the stormy appearance of the scene.

Fire Views

Should the subject be a fire scene, finger red all over the slide and work purple up into the smoke, which is afterward shaded up with black and everything within the glare of the fire kept decidedly red.

The flames are worked in with yellow, the bottom of each flame being tinged with crimson, a red cover-glass is bound over the front of the slide to complete the illusion desired in the picture.

Snow Scenes

I do not think there is anything in the shape of a lantern slide so pretty as a good snow scene, especially if it is made from a negative that is not too contrasty.

Do not imagine there is nothing to color in a snow scene or that coloring will spoil its beauty. Try it! The sky is the principal part of the slide to consider in painting a snow scene.

The peculiarly leaden appearance the sky has after a fall of snow should be carefully preserved in such pictures. Mix a bluish purple for the snow itself and brush lightly on the slide. With a second brush and "thin" medium mix a little blue, black and red until you have a dirty lead-color, rather blacker than you really require. Brush this over the sky and finger the purple over once quickly to smooth it, then finger the sky once quickly all over to smooth it out a little; after this keep cleaning the finger and work over all the slide with quick fingering until the whole is quite smooth.

The purple should be very light and only show just a trace of color, its sole use being to increase the shadows wherever necessary. Now take one of the stumps and pick off the snow, leaving a little purple on one side for shadows and gently softening the high lights into the shadow by fingering, keeping the finger quite clean all the time. Where any straight heaps of snow have drifted, say from one roof to another, let your purple make a faint shadow to show where the lower roof commences.

If there is any expanse of road or foot-path, break this up by a few artistic touches of the stump and soften by fingering, keeping in mind that snow is white, but even in white there should be a little shadow or detail.

Pick out, with the pointed stick, the boughs of trees that are laden with snow and any other small objects. You can make the snowfall look much heavier by the thickness of the white line picked out along the tree boughs, edges of fences, etc. If the purple on the snow seems too heavy, smear it across with the stump to take some of it off and then re-finger to make all smooth.

There will not be any ground color required for snow scenes unless it happens that there is a roadway where the snow has been swept and then this is painted with a darker color mixed by adding a little black to the regular Sienna, yellow and red.

The purple, for shading, should be a little bluer than usual and not too heavy; for foliage you should use a good dark green with a little black in it to indicate the decay of winter's touch,

Dirty dark browns and black complete the colors for snow scenes. Those who want the wintry effect to be exaggerated should take two slides of the same subject and, painting one in the usual way for winter, treat the other as a moonlight winter scene, keeping the sky a rich blue and increasing the depth of purple for the snow, putting in the shadows afterward with a gray mixed from blue, black and red. The result will be worth the time expended.

Street Scenes

This class of slides can be considerably improved by coloring. Their variety is so great, that the colors introduced add a brightness that is never seen in a plain slide. There is natural brightness of color in all street views which the casual glance does not catch, but which will enhance any picture which seeks to reproduce its subject properly. Thus we have the ordinary city street with its white marble and light stone buildings, to say nothing of those that are darkened with age or built with yellow or red brick, striped awnings, window shades of tan and green, all providing touches of color.

The light stonework is mixed with yellow and sienna very lightly applied, and shaded with purple and gray. The windows are shaded with purplish gray; red brick-color is mixed with sienna and red in varying proportions to suit the particular scene in hand.

Village street and country roads with their brick and wooden houses, red tile or thatched roofs, offer fresh combinations of color. It is almost impossible for me to tell how each individual color is to be prepared, but a little practice on the lines I have dealt with and the reader's natural color sense will guide him in the proper treatment of the individual slide.

You see trucks, horses, dogs, automobiles, etc., in the streets every day, and can easily determine for yourself how to paint them, being careful not to make any individual object too prominent to the detraction of all other features.

Portraits

In portraiture there are not many things to study, excepting the different grouping of colors where you have several people in one group with colored dresses or uniforms, and then you must be careful to balance the picture on each side with light or dark colors. Backgrounds should usually be purple, gray or blue, and fingered all over the slide, picking off with the stump all light garments, the faces, hands, hair, etc.

The flesh colors are mixed with yellow and red in varying proportions and applied very lightly; a small brush should be used, the different ages of people being indicated with color. Very young children have generally a ruddy complexion, so that the color should be pinker, whilst the older the person the more sallow will be the skin, but only on some types of orientals is the flesh very yellow. Indians, mulattoes and negroes, are, of course, red, brown, black-brown, or black, as the photographs will indicate.

The many shades of hair can be mixed with yellow, brown, blue and black, the yellow giving us the golden curls of youth, whilst the blue and black will give the shades of gray which accompany age.

The variety of shades of brown that can be produced is exhausted only when you are tired of varying them. Clothing is painted with good depths of plain colors, shading them with a deeper tint of the same color, or mixing a little black in the blues and grays, and a little dark brown in the reds.

If the eyes are large enough, a touch of blue, brown, or black will give a more natural effect, as will also a touch of color on the trimmings of ladies' dresses, ribbons, etc., the same remarks applying to neckties and cravats. Figure studies are treated in much the same style as portraits, keeping the background as subdued as possible in order to give greater prominence to the figure as the principal interest.

Comic Slides

When preparing slides for exhibition, the children must not be forgotten, and for their benefit and amusement it is well always to have a few comic slides on hand Excellent pictures of this kind can be copied from the comic magazines, but before doing so the permission of the publishers should be secured, as it frequently happens that the drawings are copyrighted and permission to copy secured beforehand will prevent any unpleasantness later.

Comic slides should always be colored, and bright colors should be used as far as possible without making them look ridiculous. You can do more to amuse and instruct children with a colored slide than you can with a plain one, as the color leaves a more lasting impression and oft will be the request to repeat an exhibition that has amused the children.

Flower Studies

You must go a long way to find any one who does not admire flowers whether in nature or a photograph, and if these are colored they look really beautiful. The choice of subjects is unlimited, and the mass of color that can be introduced without undue liberties with nature is astonishing. But it is as well to know something about the flowers before attempting such liberties. The best effect is produced when the flowers are light in color, or where a bunch of flowers of one color have been selected, so that the different shades of this variety may be supplied by color.

A vase or bowl of roses, chrysanthemums, sweet-peas or hyacinths, all of one color, can be tinted to show the many beautiful shades found in these blooms. The background for these should be dark and fingered a blue gray or purple, then the shading on the whites and pinks are worked in, the slides baked and the brighter and heavier colors supplied last of all. Do not get the foliage all one shade of green, as you never see this in nature, whilst it makes the coloring flat and weak.

Interiors

I have refrained from mentioning the painting of interiors until now, as they are so varied in character and require a little more skill than the subjects previously treated. It will not, however, be right to pass them without explaining the method of coloring.

The light and shade in a photograph of an interior is generally much more pronounced than in any out-door view, and must therefore be taken into consideration when painting, the aim being to produce a colored picture that will be restful and pleasing to the eye without looking glaring or vivid in color. As many photographs of interiors have some heavy shadows, it is difficult where the general appearance of the walls is light to get any color to show; we therefore commence in such a case by mixing a purple. Do not put it on too heavy, but finger it out well, keeping it off the carpets and rugs, and very light on chairs, etc., that are in the shaded parts of the view.

With the stump pick off the high lights and anything that has to be painted some other color, such as the white margins around pictures, picture-frames, furniture, woodwork around doors, etc.

If there are any windows visible, these are fingered light-blue, unless there is a view outside the window; in such case paint the view as bright as possible, so long as you make it look natural, which will increase the effect of distance when the picture is finished.

The furniture may be oak, walnut, or mahogany; each of these colors is prepared with red, sienna and black, in different quantities and mixed with "fat" medium. Do not put the color on too heavily, especially where the furniture is half buried in shadow.

Carpets and rugs are painted to suit the general tone of everything else in the picture. If there is any pattern on the carpet to be worked up, put the flat or first color on before the slide is baked. If there should be a pair of pictures on any of the walls, one of which is in heavy shadow, do not paint the picture-frames a different color; even if your color will not show through the heavy deposit in the shadow, paint it just the same, it will give it a little more prominence when projected on the screen. White curtains should be lightly shaded with purple. However, when I say purple, I do not always mean the same shade; there can be a dozen or more different shades of purple, the one to be used being left to the judgment of the colorist, since it would be impossible to specify any particular shade. The same applies to all other colors mentioned, and, with the five colors given on an earlier page, one can make every other color required.

If you have a large expanse of yellow to paint, it will be necessary to shade it, and as yellow takes a long time to dry you do your shading first with a mixture of yellow and red,—do not put it on too heavily but bake well,—then, when you are ready to use the yellow, mix it with plain varnish and as small a brush as possible, this will make the yellow dry very bright.

If medium only is used for mixing yellow, it loses its brilliancy and does not look so well. Red is another color that looks much better when mixed with varnish, but dries more quickly than yellow and is therefore not so easy to work.

If you have any large blues to paint, draw the brush over them as quickly as possible and avoid going over the same place twice, as it makes the color streaky and uneven in shade.

Black also should be put on sparingly and quickly and with as "thin" a medium as possible for flat black, using a "fatter" medium for shading.

Having carefully followed my instructions in using the various colors and materials, and diligently practicing until you have mastered the peculiarities of each, I am sure you will be able to color your lantern-slides successfully.

Before leaving you, let me once more impress upon you the urgent necessity of keeping everything spotlessly clean and free from dust. Always wash your brushes, etc., in some clean turpentine when you finish work, and you will always find them clean and ready for use; this will also keep them in good condition, and with care they will last for years.

Coloring Slides with Water-Colors

BY ROBERT MELVILLE

Under this caption are usually classed all the methods of coloring lantern slides which employ dry or moist water-colors of the transparent class, albumen colors, aniline dyes and other commercial colors or tints which are diluted with water in use. Most of these methods are very simple and, consequently, more generally favored than the alternate methods wherein oil- or varnish-colors are used. They are especially useful where large numbers of slides have to be colored or tinted in a short time, and where elaborate or careful work is not of vital importance. Most of the colored "moving-picture" slides, for example, are colored by these methods. This is not to say that slides colored with water-colors or dyes are in any way inferior to those more elaborately treated with oil-colors, but only that the methods are simpler in practice.

In earlier days the lantern-slide colorist had to seek out for himself, by experiment among the different makes of water-colors available, those best suited for his purpose. The colorist of today is more fortunate, in that there are many commercial sets of colors ready to his hand, prepared especially for lantern-slide work. As the use of these has completely replaced the old method of picking up odd colors here and there among the water-colors prepared for painters and art students, this paper will necessarily bristle with commercial references. These references are given simply in the interest of the reader and not for the sake of advertisement, according to the policy of THE PHOTO-MINIATURE since the beginning.

Commercial Colors The best-known commercial colors available for our purpose are the Elmendorf colors, the Japanese water-colors, Savigny's transparent water-colors, the Acme colors, Revoli's photo-tints and Petzold's trichromatic colors. In Britain, Wagner's albumen colors are much favored for lantern-slide work, but, as far as I am able to find, they are not obtainable in this country. With this exception, all the colors mentioned can be had from most dealers in photographic supplies. For aniline dyes it is better to deal direct with a large chemical house such as Merck, of New York and London.

Tools Apart from the colors, the essential tools are few and easily gathered together. A palette will be needed; this may be a piece of opal glass, or an ordinary plate turned upside down, or a few individual butter-dishes, or the little nested glass or porcelain saucers used by microscopists. These are made to fit one on top of another and after use can be piled up, each forming a cover for the one underneath, keeping the colors free from dust when not in use. A few red sable brushes, say Nos. 2, 4, 6, 10 and 12, will meet all requirements. A piece of fine soft sponge or soft rag, blotting-paper and two or three small containers for water complete the equipment. For a working desk many colorists use an ordinary retouching-desk, but a stout, smooth piece of wood, grooved to take the edge of a slide, and deep enough to serve as a rest for the hand, will do as well. The beginner will probably work to most advantage with his slide placed flat. Lay a piece of thick or plate-glass on two thick books or any similar support, leaving a reasonable amount of working space between, and in this space place a sheet of white paper or card to serve as a reflector throwing light up through the glass upon which the slide is placed for coloring. The slide itself should be shielded from direct light as far as possible and the coloring done by transmitted light.

Light to Work with Since colors look different by different lights and the color effect on the screen is the vital point, it is well to have a standard slide to go by, i.e., a colored slide which has been pronounced satisfactory by one competent to judge, after test upon the screen. A yellow light is perhaps the most unsatisfactory of lights for our purpose; Welsbach incandescent gaslight is a good all-round light but gives off too much heat for comfort in working; daylight, at a window with a northerly aspect, is the illumination most favored as fairly uniform and least trying to the eye for continuous work.

Preparing the Slide

Among the difficulties encountered by beginners in lantern slide coloring none is more discouraging than the peculiar obstinacy with which some slides refuse to "take" the colors applied. Slides differ largely in this respect, presumably due to the varying chemical treatment given them in their making. The presence of alum (used to harden the film by some workers) will at times prove a source of difficulty with some colors. At other times the film of a slide will be repellent of color and almost greasy, although its surface may look quite clean. "Wet-plate" slides, having a collodion film for the surface to be colored, are generally troublesome. This, however, is easily remedied by the following method of preparation, given me by an expert colorist and proven in years of practice.

Cover a quantity of (say half-ounce of Cox's or No. 1 Nelson's) gelatine with cold water; allow it to swell thoroughly, say an hour. Drain off the excess of water by covering the vessel with a thickness of cheese-cloth. Do not press the excess of water off, merely drain it and take time. Set the gelatine in another dish containing hot water until it melts; then take it out and stir in alcohol (use photographic 95°) slowly until white follows the addition. This you redissolve by dropping in hot water in the same manner. Filter through two thicknesses of cheese-cloth into a wide-mouthed bottle. If too thick to flow when warmed for use, add alcohol and water as before, wet the binder of the slide on its edges, and scrape it off from the glass. Flow the surface of the slide with alcohol, one part; water, two parts; then follow with the gelatine solution twice or more.

Ordinary gelatine or "dry-plate" slides which refuse to "take" colors may be treated in various ways. That recommended by Dr. Elmendorf, for use with his colors, is to soak the slide for a few minutes in a five per cent solution of formaldehyde, then rinse in a gentle flow of water, drain and dry away from dust. This works to perfection with his colors on all the different "dry" slides with which I have used it, and is the surest way of avoiding trouble. Another way is to prepare a solution of albumen by beating up the whites of two eggs and allowing the mass to settle. Add a little water and flow the solution over the slide. This gives a thin, even film of albumen to the slide, very receptive of color. In the same way, a weak solution of gelatine, applied warm with care, will give a receptive surface to a recalcitrant slide. With some colors, or where it is desired to apply successive washes of color to get force or brilliancy, it is best to use the particular "medium" or "solution" prepared by the maker of the colors employed.

Elmendorf Colors

The exquisitely colored slides used by Dr. Elmendorf for the illustration of his travel lectures led to many enquiries as to the colors employed and the method followed in their coloring. In response to these enquiries, Dr. Elmendorf published his method of making and coloring slides and put the colors on the market in convenient form at a nominal price. These quickly won wide popularity, but for some time past the handbook has been out of print and the colors have not been obtainable. Within the past few months, however, the colors have again been placed on sale, so that the method is still available for use. I therefore make room here for a brief resumé of the instructions for the use of the colors.

The List

The Elmendorf Colors are carefully selected aniline dyes of great concentration and brilliancy, so prepared that the colors are permanent and will not creep or overspread their boundaries when applied with ordinary care. As offered commercially they come in sets of ten colors: 1, light yellow; 2, dark yellow; 3, orange; 4, rose; 5, vermilion; 6, brown; 7, maroon; 8, green; 9, blue; 10, violet. Any desired tint or shade of color can be reproduced with these ten colors by combination.

Thus Nos. 1 and 2, mixed with a very small quantity of No. 4 give several tints for flesh or evening skies. Nos. 2 and 5 mixed in varying proportions give a wide range of tints from flesh to terra-cotta. No 6 is reddish brown and gives many tints of brown by careful admixture with No. 2 or No. 9. No. 8 is a new color, giving all tints of green when mixed with Nos. 9 or 2. No. 9 alone gives varying shades of blue by simple dilution for sky and delicate atmospheric effects. Other combinations will reveal themselves as the worker becomes familiar with the adaptability of the set of ten colors.

The average gelatine slide will respond to the application of the Elmendorf colors without difficulty, but it is advised that, before beginning to color, the colorist should be sure that the slide is thoroughly fixed and that every trace of hypo or soda has been thoroughly eliminated by careful washing. No alum, or preparation containing alum, should be used on a slide to be colored with these colors, or they may not work satisfactorily and will possibly change color. If the surface of the slide gives any indication of softness, the application of a bath of a 5 per cent solution of formaldehyde will remedy the trouble. After soaking the slide in this solution for a few minutes, rinse it in a gentle stream of running water, drain and set aside to dry.

Method of Working

To color the slide, place it in front of the ground-glass support of a retouching-desk or other convenient working-support. Use separate brushes for different colors. These should be of camel's hair of good quality — round brushes for small surfaces and details, flat brushes, about half an inch broad, for large surfaces. Distilled water should be used in diluting the colors or working on the slide during the coloring. In coloring a landscape, take a flat brush, charge it with water and wet the sky evenly and completely. Squeeze out most of the water by passing the brush between thumb and forefinger, dip it in very dilute blue color and apply this to the sky, brushing it quickly back and forth over the wet sky without allowing the brush to rest on the sky. By using sufficiently dilute color and a little dexterity, repeated applications will produce an even tint of the desired depth over the sky portion of the slide. In blending a sky, as for an evening effect, choose from the yellows or rose and brush a dilute solution over the lower part of the sky. Now dilute the color still more and gradually pale it off to the zenith. Then, with a brushful of the dilute blue color, gradually work down the sky from the zenith until a perfect blending is secured. It is well to color the skies of several slides at one time and put them aside to dry before coloring the other portions. Remember that, unless blending is wanted, the first color applied should be allowed to dry before another color is put on.

In coloring trees, first apply a tint of pale green as a wash, working out the details in each tree later with various tints of stronger greens, mixed with yellows or brown according to the coloring of the season. Branches or conspicuous masses of foliage require more careful treatment and a little practice. Repeated application of dilute colors until the desired color is obtained is the secret of success in these methods.

Caution

Rose and vermilion are remarkably powerful and penetrating, and should be handled with moderation until their coloring qualities are fully appreciated. Do not use the colors too strong, as this will produce blotchy and glaring effects. Two or three successive applications of a dilute color will give better results and more harmonious tints than concentrated colors.

Another Method

Another method of using aniline dyes, is as follows: The slides should be extremely thin, with good gradation, as the densities of the image are to supply the half-tones of the picture. The colors suggested are the every-day aniline dyes of commerce, viz., olive green (light and dark), napthol-red, methylene-blue, methyl-violet, nigresin, and carbazol-yellow. Very small quantities of each dye are required and concentrated dye solutions may be conveniently made up in one-ounce bottles. The medium is next prepared as follows: Take selected, clean gum arabic, one-half ounce; glycerine, 20 minims; carbolic acid, 1 minim, and distilled water, 2 ounces. Suspend the gum in a small muslin bag at the top of the water, and leave it until wholly dissolved, after which add the glycerine and carbolic acid. If any sediment forms, filter the solution, which, for use, should be quite clear. Water-color sables are used in applying the colors, with a flat brush for the large spaces.

Applying the Colors

The method of coloring advised is peculiar and would seem to require patience and some little practice for successful working. There is little or no brush work of the usual kind, except for the sky or similar large spaces. A small blob of the gum water is placed on the palette and then a drop of the dye solution of the desired color, the two being placed side by side and carefully mixed with a small brush until the particular shade or dilution of color required is obtained. The secret is to use as little of the gum and as much color as possible, and to apply the color in a series of small dots, which are dropped from the brush and made to run together with a touch of the brush top. For the larger spaces, of course, the gummy color solution is applied in larger amounts and gently guided until the space is covered with an even film of color. Dilution, if required, is done with plain gum-solution, not water.

Savigny Colors

The Savigny transparent, moist water-colors are favorites with many expert colorists because of their great brilliancy and purity. They come in collapsible tubes in a range of twenty-three colors, from which the worker can readily select a set of ten or twelve covering his particular needs. They have remarkable penetrative power and should be applied in very thin washes, working smoothly and without difficulty on the gelatine film.

Japanese Color Films

For convenience and simplicity combined with practical efficiency, the Japanese transparent water-colors, which come in book-form as a series of color leaflets, deserve special mention. The colors are supplied dry on sheets of paper, and, to mix, all that is necessary is to cut off a small strip and place it in a few drops of water when a color solution of wonderful power and penetrative quality is obtained. The colors flow smoothly and combine perfectly, giving any desired shade or tint.

The booklet offers fifteen colors, with an interleaf of information for use preceding each color film. The secret of success with these colors lies in acquiring the knack of applying the colors rapidly in weak successive washes as far as the larger spaces of the slide are concerned, so that the blending powers of the tints are fully utilized. The details of the picture are afterward touched with stronger colors applied with a fine brush. For the quick, effective coloring of slides, as well as for a close imitation of the peculiar delicacy of the Japanese colored slide, these are colors preëminently adapted.

Revoli Tints

Revoli's photo-tints, supplied in the form of moist water-color cakes, also provide a convenient set of lantern-slide colors in an inexpensive form. They have the requisite transparency and permanency, and do not spread or run. These tints should not be mixed or combined before use, the different shades of color desired being secured by washes of one color over another on the film of the slide.

Petzold's Trichromatic Colors

Petzold's Trichromatic Colors come in the form of three solutions: yellow, red and blue, the different shades being obtained by combinations of three or two colors as the case may be. They are extremely simple and effective in use, their application in lantern-slide coloring following the general lines already laid down.

Acme Colors

The Acme colors provide a wide range of transparent water-colors well adapted for lantern-slide work. Usually they may be applied direct to the film of a gelatine slide. In cases where the film is at all repellent, it should be carefully wetted and then flowed with Acme medium. "Wet-plate" slides invariably require this preliminary treatment with Acme medium. The colors are applied rapidly in thin washes, any surplus of color or overlapping being at once removed with a small piece of sponge or a wedge of lintless blotting-paper. Because of their transparency, the Acme colors combine with great facility to form any desired shade or tint. For these combinations the reader is referred to the handbook which accompanies each set of the colors.

Hints for Practice

In the use of all these commercial colors there are little peculiarities to be observed in handling, particulars of which will be found in the instructions accompanying the colors. Apart from these minor, but important details, the same general treatment applies to all. The chief thing is to acquire the necessary facility in the use of broad, flat brushes to apply weak, but even washes of color or tint, thus covering the sky and larger spaces. Where needed, the colors are strengthened by successive washes or the careful application of stronger colors. Blending is accomplished by washes applied before the preceding wash of color has dried, the second color being diluted and gradually worked off into the other by imperceptible gradations, this being helped by a second application of the first color, very much diluted and worked down into the blending color.

Portraits

The coloring of a portrait-slide calls for more care and skill than the landscape or view. Begin with diluted flesh-color and wash over the face except the eyes. Before the first wash is dry, go over it with a second wash, leaving the broad, high lights untouched. The shadows and darker parts are next strengthened by a third wash, a very small trace of brown being added to the dilute flesh-tint for this application. In some cases a faint wash of light yellow may be given to the highest lights. A light red is used for the lips and the suggestion of color in the cheeks. For brown eyes a touch of flesh-color and brown will, with the color of the film, give a sufficient suggestion of color. Similiarly, a touch of blue will brighten blue or blue-gray eyes. The hair should be colored with an even, faint wash, without local strengthening, save where the subject has hair of a very decided tinge of red or auburn. It is difficult to put too little color on a portrait-slide, the mere suggestion being altogether preferable to the over-colored portrait.

The beginner will do well to choose his first subjects from those which will give desirable color-effects with broad washes, thus gradually acquiring the necessary facility with his tools and colors, after which subjects requiring detailed treatment may be attempted with a better chance of success. It is especially advised that the novice train himself to work quickly and accurately, and to avoid spending much time in the endeavor to get effects by working over and over a slide. A better plan is to put the slide aside and take up another, repeating this until the eye and hand work together without laborious effort. The most satisfactory colored slides are those which are colored quickly and easily, the colors being suggested rather than emphasized.

Notes and Comment

A few days ago we had the pleasure of seeing a collection of color photographs made on the Lumière Autochrome plates—the first examples shown in this country. The exhibition was arranged by Mr. Alfred Stieglitz immediately on his return from Europe, in order to afford his friends and the pressmen of New York an opportunity to see for themselves the possibilities of the new process in the hands of men thoroughly versed in photography. For his good will in this, Mr. Stieglitz deserves, and doubtless knows that he has the appreciative thanks of all concerned.

The exhibition was held at the Little Galleries of the Photo Secession of Fifth Avenue, and comprised some twenty odd examples of the process, chiefly outdoor portraits, genres and copies of paintings, selected from the work of Messrs Steichen, Stieglitz and Eugene, who have been busy with the method in Europe since its first demonstration in Paris last June.

It is difficult to describe the sensations experienced as one saw the great problem of direct color photography realized in these wonderful pictures. Our readers must see them and produce them for themselves in order to properly appreciate the magnitude of the advance in photography which they represent. Many of the portraits shown were of men and women with whom we are well acquainted, and yet the fidelity of color and the illusion of life in the reproductions were so perfect that we could find no room for criticism, but rather innumerable subtleties and qualities which called forth enthusiastic praise and commendation in spite of the restraint born of a natural conservatism in such matters. Briefly, the examples left no room for doubt or dispute that direct photography in colors is an accomplished fact, and that the Lumière plate offers a practical means of obtaining, by the simple exposure and development of a single plate, photographs of things as the eye sees them, with all the color and luminosity contrasts perceived in the object.

The Autochrome plates are now openly advertised for sale by the British branch of the Lumière Company in London. The 3¼ x 4¼ plates are sold in boxes containing four plates, at 4/6 ($1.08); the special color screen required costs from 5/ ($1.25) to 12/($3) according to size; and a complete set of the chemicals for the various baths costs 7/ ($1.75.)

The volume of information concerning the process, published from week to week in our British and Continental exchanges, has reached such proportions that we confess our inability to give even an intelligent summary of it in these pages without devoting the whole of the magazine to this subject alone month by month. Most of the information, however, has appeared in the English weekly "Photography," the editor of which paper has republished the matter with revisons to October 1, in a booklet which sells at fifty cents. A useful digest of the various manipulations as recently revised by Messrs Lumière, appeared in the "Photographic News" dated September 27, together with a table of possible failures and remedies. We are also informed by Mr. Alfred Stieglitz that the forthcoming issue of his quarterly, "Camera Work," will contain an account of the experimental work of Steichen, Eugene and others with the new plates, and that the journal will hereafter devote special attention to the possibilities of the method in pictorial photography.

So far, the American branch of the Lumière Co. make no sign or announcement in the matter, but, with all the activity abroad and Mr. Stieglitz at this end, it is likely (despite "wireless" and the Lusitania) that Lumière color photography will be in full swing in America within a year of its appearance in Europe!

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In the *British Journal of Photography* dated September 13, 20, 27 and October 4, much space is devoted to the Powrie-Warner Color Process, which is said to have remarkable commercial possibilities. This method, although comparatively unknown in this country, is American in its origin and development, being the invention of Mr. John H. Powrie and Miss Florence Warner, of Chicago, and is based on the use of a ruled screen-plate in combination with a panchromatic emulsion. This "Heliochromatic" plate gives a negative of the subject in colors (complementary), or, if the negative image be reversed, a direct positive transparency in colors, the process being described as quite as simple as the making of a lantern slide. But the essential feature of the process is that, without in any way altering this preliminary operation, the color negative or positive is available for: (1) preparing duplicates; (2) preparing prints on paper by the pinatype method or the use of Uto bleach-out paper. The plates are not yet commercially available, but are said to be sufficiently rapid to permit of exposures of $\frac{1}{50}$ of a second.

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All the lantern-slide colors mentioned in this issue should be readily obtainable from dealers in photographic supplies, but for the convenience of the reader we give the addresses of the various manufacturers or agents. Elmendorf colors (George Murphy, Inc., New York); Japanese colors (Japanese Water Color Company, New York and Boston); Savigny colors (Savigny School of Painting, Detroit, Mich.); Petzold's colors (G. Gennert, New York and Chicago); Acme colors (Acme Color Company, Chicago); Winsor & Newton and Rowney's colors are carried by all art stores, Devoe & Raynolds Co., New York, trade agents; Revoli Photo-Tints (Revoli Photo-Tint Company, Glenside, Pa.); Aniline dyes from E. Merck Company, New York.

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With so much color coming up over the photographic horizon, it is not easy to get back to plain black-and-white records, but there are a few things of interest which should find mention this month. First among these is the introduction by J. L. Lewis, New York, of the Barnet C. G. (Contact Gaslight) lantern-slide plate, already well and favorably known in Great Britain.

Every lantern-slide worker should give these plates a practical test. Their manipulation is exactly similar to and as simple as the making of a gaslight print, and the sample box we exposed gave us slides with a fine range of warm black to sepia tones, very pleasing in softness and unexceptionable in the transparency of the shadows. We predict a widespread popularity for these C. G. plates as soon as their advantages become known. One can hardly imagine the making of lantern slides being reduced to greater simplicity, and the introduction of these plates will, doubtless, do much to increase the popularity of the optical lantern for home entertainment and public use.

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Referring to the statement made by Mr. G. Hanmer Croughton, on page 442 of our September issue, that he had failed to get successful Ozobrome prints with gaslight papers, the Eastman Kodak Company asks us to say that the process works perfectly with Velox, Azo and Nepera development papers, but that the prints should be fixed in a plain hypo bath and not, as is usual, in an acid-fixing bath. The Ozobrome booklet, just issued by the Eastman Kodak Company, and obtainable from most dealers, fully explains the making of Ozobrome prints. The demonstrations of the process now being given at the conventions and Aristo schools are arousing a great deal of interest, especially among professional photographers, to whom the process offers a considerable economy in the production of enlarged portraits in carbon. On the other hand, in Europe the process is largely used by amateurs for the making of exhibition or portfolio prints with little expense or trouble.

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The American Annual of Photography for 1908 will be ready for distribution during November. A glance through the advance sheets of the book gives us the belief that the new publishers have made good their promise to produce a better "Annual" than ever. By changes in the make-up of the volume, room has been made for a larger series of practical papers on photographic topics, including several articles of unusual interest and length. The illustrations—about three hundred in number—include a photographic frontispiece and thirty-two prints in color, so that the book offers a veritable treasury of suggestive illustration and helpful information. It should not be forgotten that last year the "Annual" sold out within a few weeks after publication and many were disappointed in not being able to secure copies. The surest way is to place your order with your dealer now and have him reserve a copy for you. The trade agents are George Murphy, Inc., New York, who will distribute the entire edition to the trade, so that the "Annual" will be everywhere obtainable through local dealers. The prices are: Paper covers, 75 cents; library edition, cloth bound, $1.25. When sent by mail, the postage is extra; 17 cents for the paper-covered edition and 22 cents for the library edition. Thus, it is a practical economy to get the book through the local dealer.

⁂

Photograms of the Year 1907 will also be ready during November. As usual, this will be the pictorial worker's yearbook, reproducing, describing and criticising all the best photographic pictures of the year. About two hundred photographs will be carefully reproduced on art paper, the collection being selected from the work of British, American, German, French, Spanish, Canadian and Australian photographers. The great exhibitions of the year are fully described, with illustrations. Altogether, *Photograms of the Year* is an annual which no one interested in pictorial photography can afford to miss.

⁂

Among the American exhibitors at the Royal Photographic Society's show this year we note: D. H. Brookins, Chicago; D. A. Davis, Worcester, Mass.; Rudolf Eickemeyer, Jr., New York; A. G. Eldridge, New York; Louis Fleckenstein, Faribault, Minn.; F. E. Ives, New York; A. J. Meyer, Long Branch, N. J.; Misses W. and G. Parrish, St. Louis; Mrs. W. W. Pearce, Waukegan, Ill.; W. H. Porterfield, Buffalo, N. Y.; Carle Semon, Cleveland, Ohio; L. D. Sweet, Minneapolis;

Mrs. E. W. Willard, Grand Rapids, Mich., and Dr. Walter Winchester, Sheboygan, Wis.

At the London Salon, for some reason unexplained, the American Photo Secession was represented solely by Mr. C. Yarnall Abbott, of Philadelphia. Mr. H. Mortimer-Lamb, of Montreal, had two prints accepted, as had Mr. Sidney Carter, of Toronto. On the whole, this is not a bad showing for American pictorial photography. The exhibits sent by Mr. F. E. Ives do not, of course, come under this classification, being "New-process photographic copies of diffraction gratings."

⁂

Lens catalogues are all de luxe these days! The last to reach our table is Catalogue H, issued by the Bausch & Lomb Optical Co., Rochester, N. Y. It is a beautiful bit of bookmaking and altogether satisfactory as a lens catalogue. Several pages are devoted to useful information concerning lenses, with diagrams. The page which discusses "Cemented Surfaces *vs* Air Spaces" is especially welcome as dealing in a common-sense way with a point about which many lens users have a confused notion. It is needless to suggest to our readers that they should possess this new list and give it the careful perusal it deserves.

⁂

The Anthony & Scovill Co. (now officially styled the Ansco Company) Binghamton, N. Y., has just issued a new and thoroughly revised edition of the Cyko Manual, a complete guide to the successful use of this well-known development paper. Copies may be had on application.

⁂

It is interesting to note how many European photographic specialties are now American workers. The list is too lengthy to give here, but it thoroughly refutes the notion that we are groaning under monopoly. Among these imported specialties a prominent place must be given to the Imperial plates, for which the firm of G. Gennert, New York and Chicago, is the American agent. The Imperial plate is notable for its combination of speed and gradation capacity, its fine-grained emulsion being rich in silver so that it can safely be carried along in development to any desired density without fear of veiling or fog. For studio work in the dull-lighted winter months such a plate has many advantages. Lantern-slide makers who have not yet tried the Imperial lantern plate will find it well worthy of their attention. It is used by some of the most critical lantern men here and abroad, who give it unstinted praise.

❧

As we go to press, we are in receipt of several novelties in development tanks from George Murphy, Inc., New York, and Burke & James, Chicago. Notes on the use of these will appear in our December issue, which will be wholly devoted to tank and time-development. Meanwhile, those interested in tank development should send to the firms named for descriptive literature about these new models. Tank development has lingered long but now seems to have come to stay.

❧

The Bausch & Lomb Optical Co., Rochester, N. Y., are again busy making extensive additions to their already enormous plant. Two years ago a three-story building was erected to be used solely for administrative purposes. The urgent need for more space in the manufacturing department, however, made it necessary to encroach on this new building, so that new buildings had to be undertaken. Two additional stories are being added to the administration building and north of this site a five-story grinding plant, 119 x 238 feet is being rapidly pushed forward. When these are completed the plant will have almost double its present floor space—about ten acres in all.

❧

Ausfuhrliches Handbuch Der Photographie, von Hofrat Dr. Josef Maria Eder. Third edition, entirely revised and enlarged. Vol. I; Sec. 1; Parts 1 to 15. Issued at one mark each. Halle, Germany: Wilhelm Knapp. 1907.

The appearance of Dr. Eder's "Detailed Handbook of Photography" in a third edition, entirely rewritten and enlarged, signalizes in all probability the definitive form of this monumental work, the nearest approach to be expected to the ideal "Encyclopedia of the Art and Science of Photography"

As now planned, the entire work will be comprised in four volumes; volume one being issued in two sections. The first section, now at hand, covers over 486 pages of text and indexes, and is issued in fifteen separate parts at one mark each, which puts the work within easy reach of all students. Each part is well illustrated, both in the text and by separate plates, a total of over 1,500 such illustrations being promised.

The first section here noticed is entirely devoted to historical matters connected with the chemical side of photographic practice in all its applications. The rearrangement of the vast mass of data brings together in very orderly array all the known facts, and discusses most of the fancies that diligent searchers have unearthed or recorded, bearing on the origins of things photographic. But even the considerable total of 500 pages imposes limits to the fullness of treatment, and, much of the matter is noticeably condensed. Copious notes and references to sources offset this drawback as far as possible, and the work seems to be, on the whole, carefully done. We note, however, a few slips, which, while of no great importance in themselves, are inaccuracies, where accuracy is expected and should be found.

The attribution (p. 180) to Isidore Niepce of the portrait bust of his father Nicéphore Niepce (illustrated on page 183) is an error. This bust is based on an outline profile, published in "La Lumière," No. 22 (Paris, July 6, 1851) with the following note: "Le petit profil que nous donnons ici est le seul portrait que sa famille ait pu nous procurer; il a été crayonné par son fils." This was reproduced in "The Photographic Times," for June, 1896. Isidore Niepce was not a sculptor—the bust was made by some one else and not, as Dr. Eder states in two places, "modeled by him."

The reference on p. 204 to "THE PHOTO-MINIATURE" No. 60, regarding the authorship of the portrait of Daguerre published in the "New Yearbook of Photography" for 1881, attributed to Mayall, is flattering; but might more exactly have been credited to the original source, the articles on the "Portraits of Daguerre" by C. W. Canfield, in the "American Annual of Photography," 1891 and 1893.

The cut on page 163, of Daugerre's one-time residence, 15 Rue de Marais, Paris, should also be credited to the same source, and the title is misleading in its inference that this was the location of the Diaroma.

In Chapter 47, treating of early journals and societies, reference is made (p. 451) to "The Daguerreotype," Boston, 1847, as the earliest photographic journal. This is a manifest absurdity, as may be seen from the subtitle of the journal, "A magazine of foreign literature and science." As a matter of fact, this was merely a literary miscellany, with no special photographic department, and, so far as the reviewer's memory serves, no photographic references, and has much less claim to mention in this connection than the London "Athenæum," for instance, which, in the decade 1840-1850, published many extracts and communications regarding such matters. The title has misled many photographic publishers. [C]

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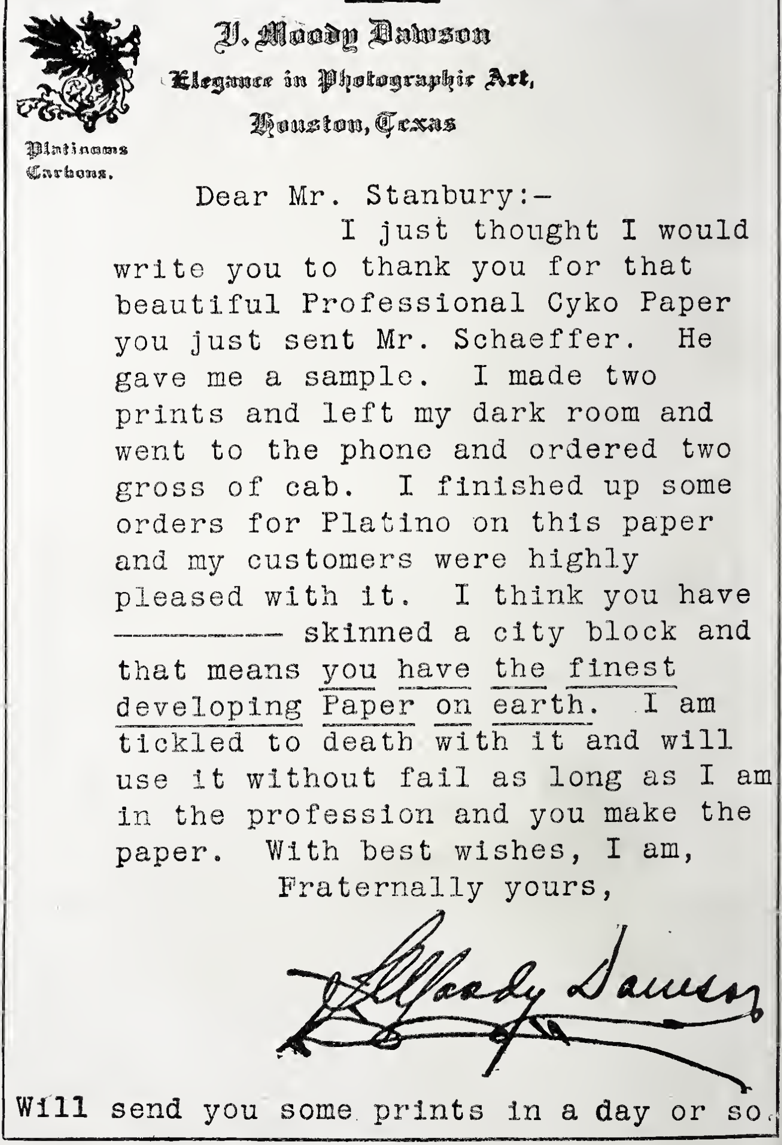

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Fraternally yours,

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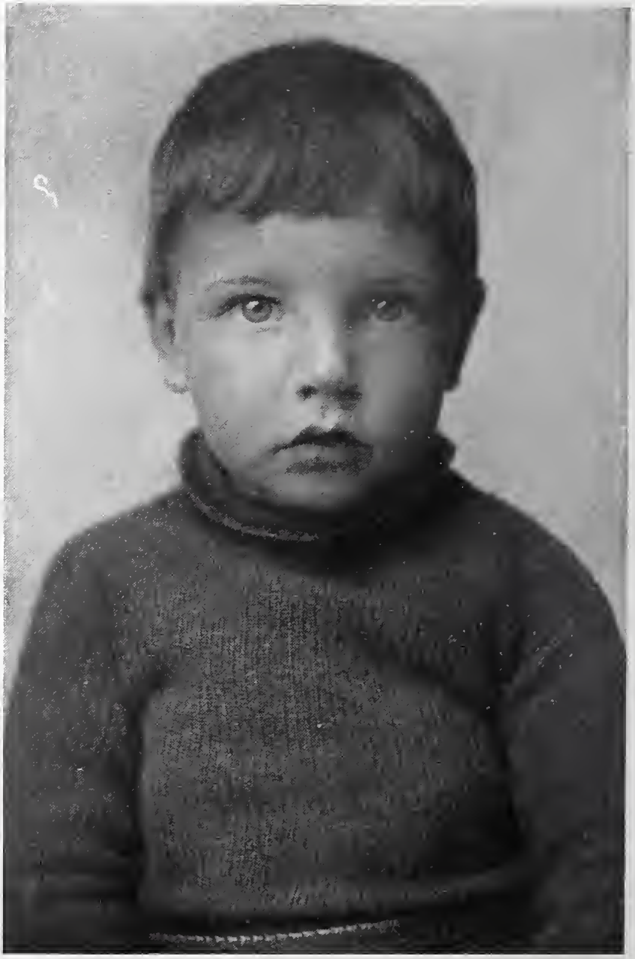

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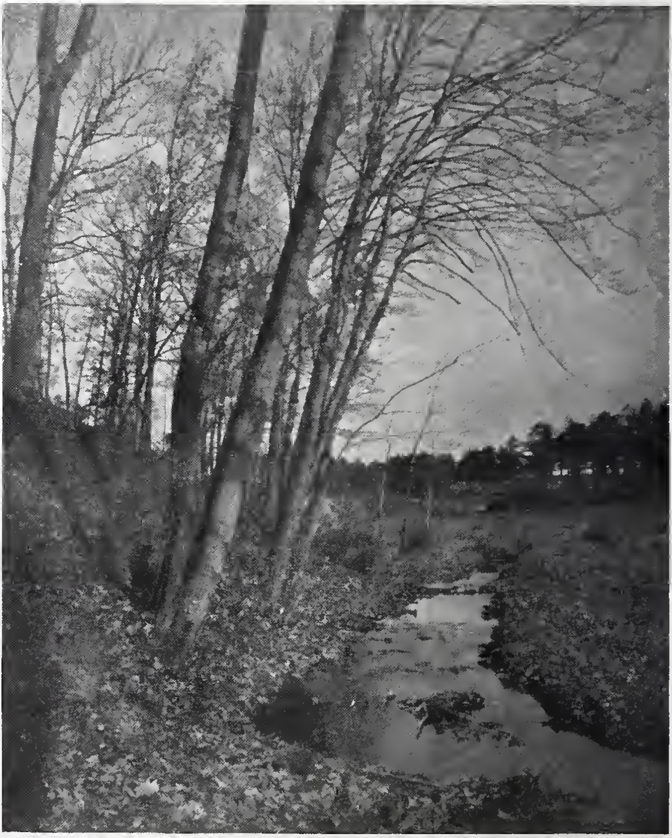

The Meadow Stream (Pinhole)
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The Photo-Miniature
A Magazine of Photographic Information
EDITED BY JOHN A. TENNANT

Volume VII DECEMBER, 1907 Number 84

Tank and Time Development

Tank development is in the air. It is the newest royal road to success in photography, the latest "foolproof" method of getting good negatives as a maker of tanks tersely describes it. The dealers' stores are lined with tanks of many sorts and sizes; photographic writers are everywhere crying to high heaven for and against the method: the amateur, whose name is legion, is busy with experiences that are not "all in the tank," despite the alluring phrase of advertisement, and even the conservative professional is inclined to give the thing a trial if he could find a common-sense tank in the market suited to his notions. In short, gentle reader, the time has come to discuss tank and time development in THE PHOTO-MINIATURE, since, with the rest of the world, we are ourselves interested in its possibilities in a practical way.

First, then, tank development, now writ large across the photographic horizon, is not a new idea. According to some, it was first advocated in 1882, when the present writer made his first excursions in photographic fields. But more careful historians aver that the method was first suggested by Dr. A. Meydenbauer in 1892. Those who have access to Eder's monumental "Ausführliches Handbuch der Photographie" will find the historical data interestingly developed in the section dealing with "Die Praxis der Photographie mit Gelatine-Emulsionen" (Halle a/S: Knapp), and "re-hashed" at some length in "Stand-Entwicklung: als Universal-Method für alle Zweeke," by E. Blech (Berlin: Schmidt). We had these translated for our information, but friendly consideration for the reader and a proper respect for the antique forbid more than the mere mention of the references here. As a later scribe says at the end of a three-page dissertation on the subject—"much that has been written about tank development is pure buncome." And so it is.

Stand Development in 1882

But I permit myself one reference to the history of the subject as showing the reader that once again modern practice is not wholly the new thing the unthinking photographer might suppose. In a recently published article, Mr. George T. Harris, F. R. P. S., an accurate and painstaking worker, gives some data relative to the early employment of stand development, which comes to me with the freshness of novelty. He says that Wratten and Wainwright, the plate-makers, introduced stand development with pyro-ammonia about the year 1882, and that it was in daily use a quarter of a century ago, by several large commercial firms, who produced negatives of great excellence and uniformity by it. Mr. Harris first saw it used in the workrooms of Mr. J. Hudson, the photographic publisher, who employed it exclusively for all sizes up to 12 x 10. As many as twelve dozen enlarged negatives were made and developed in one day by two persons using stand development with pyro-ammonia, on the lines suggested by Wratten and Wainwright. Three dipping baths were used by each worker, and the solution made up in the morning was employed throughout the day, being strengthened when half the work was done, by the addition of dry pyrogallol and ammonia. It is curious to find, as the reader of the present number of the THE PHOTO-MINIATURE will see for himself, that in this matter time has wrought one of its most peculiar revenges, for a notable sensation of the photographic world in the closing months of 1907, was the published condemnation of stand development by Wratten and Wainwright, and its able defence at the hands of Mr. Alexander Mackie, whose rejoinder I also present to the reader. So much for history.

Ancient and Modern

It is necessary, however, in the beginning, to point out that tank development, as we know it today, is altogether different from the tank development of which Wratten, Meydenbauer, Miethe, Fourtier, Neuhauss and others wrote so learnedly years ago. Then the system comprised nothing more than the simultaneous development of a number of exposed plates, by placing them in a vertically grooved box or tank and covering them with an extremely dilute developing solution. Time and temperature, now all important, were then of little or no account. So long as the plates did not frill, or fog or stain by prolonged soaking, the development was extended over a period of several hours, the negatives being examined from time to time, at the convenience of the worker, and removed to the fixing-bath as each plate attained the desired density. In tank development as now practiced, the tank is merely a convenient receptacle for several plates or films during their automatic development, the range of contrasts in the negative being secured by the careful adjustment of a definite formula used at definite temperature for a definite period of time—a significant difference.

The modern system is systematic in the exact sense of the word, being based on the researches of Hurter and Driffield, of which some account is given in THE PHOTO-MINIATURE No. 56. The sum of these investigations, as utilized for the scientific basis of modern tank development, is that the truthfulness of the photographic records depends upon correct exposure (within well defined limits), development simply determining the range of opacities or contrasts in the negative by its duration. The elasticity of the method lies in our control over the duration of development, this being obviously variable according to the range of contrasts best suited to the subjects in hand, the printing process to be employed, or the preferences of the individual.

A Definition

Throughout this monograph the terms "stand," "time" and "tank" development are used interchangeably, and it is as well to bear in mind that they mean one and the same thing. It is too soon, perhaps, to effect a total revolution in the nomenclature of the process: but it is probable that before long the words "stand" and "tank" will be swept from the photographer's vocabulary and that the expression "time" will be used to include all references to the subject. For our present purposes, however, it will be sufficient if the reader realizes that wherever I or any of the authorities I quote make use of the words "stand," "tank" or "time" development only one thing is meant, viz., to quote from the preceding paragraph, the employment in development of a definite formula, at a definite temperature for a definite period of time. The tank is the accessory: an important one, as we shall see, but still of subordinate interest in considering the subject in its broadest aspect, that of the entire theory and practice of photographic development.

The Science of It

Now, what are the advantages of time development over the older or tentative method? Mr. R. Child Bayley so tersely summarized them some time ago that I cannot do better than quote his exact words at the outset of this section. Said Mr. Bayley:

"1. It gives us perfectly uniform negatives when exposure has been correct, whether we develop daily or only have a few to deal with every now and again.

"2. It brings everything out that can be got out of an under-exposed plate, and removes the temptation to over-develop in the hope that more details may be obtained.

"3. It gives us as good results as can be got with over-exposed plates, and prevents any risk of insufficient development which may be caused by the difficulty of judging how far development has gone when the plate is very opaque.

"4. It reduces light-fog to a minimum, and in the case of roll films, does away with it entirely.

"5 It overcomes entirely the difficulty of determining when development is complete.

"6. It can accommodate itself to the nature of the subject or to the printing process to be used, or may be settled, once for all, to give a good, 'all-round' negative."

In time development, then, we are face to face with a condition of things almost revolutionary in effect and promise: for just as the work of Hurter and Driffield in photometry swept away all our previous notions as to the value of the trial and error system of exposure, so in time and temperature development we are getting down to the point where exactitude of method steps in to the confusion of sheer guess-work or empiricism. The signs of the times point clearly to the fact that rule of thumb in photography has received another hard blow, and that the old-fashioned worker can no longer afford to disregard the scientific method in his dark-room practice. He had best resign himself to the inevitable and throw overboard all his fossilized notions as to tentative development being of the slightest further use to him. He must realize that photography is daily more and more dependent on fundamental precision in the production of the finished picture.

It is only within the past year or two that time development has achieved anything like a vogue, and already a great variety of apparatus and material specially designed for the work has made its appearance on the market. There are tanks innumerable, some of which are figured in subsequent pages; developing and fixing powders, and the like; and above all, the Eastman Kodak Company has given a powerful impetus to time photograph by supplying a tank film developer and the necessar accessories — for tank development lends itself quite readily to roll and cut films, glass negatives, lantern slides, transparencies, and obviously to paper-positive work, although this last has so far not been prominently exploited. The man I envy is the beginner in photography who comes to us at a time when simplicity and efficiency would seem to have reached their remotest limits; the man I pity is he who will cling to antiquated methods in face of the remarkable progress that is daily taking place around us. But enough of sermonizing: let me hasten on with my subject.

Time Development Attacked

I promised the reader earlier in this monograph that I would print the criticism on time development which was recently published by Wratten & Wainwright. I do so for the reason that this house is of great eminence in virtue of the valuable research work in color sensitiveness, photometry, and other subjects, which is published from their laboratory, and that consequently very great importance is attached by photographers in all parts of the world to whatever they may contribute to the records of the progress of photography. I give the essential portion of Messrs. Wratten's paper in condensed form:

"A method of developing plates which always appeals by its apparent simplicity and economy, is that which is known by the name of 'Stand development.' At first sight this method seems easy, and at the same time, owing to the dilution of the developer, economical:—in actual fact, however, we doubt whether it is either. It can scarcely be considered economical in the first place, because the tanks made for the purpose, ingenious and convenient as they are, require a very large quantity of developer; one of the smallest, for instance, requires 29 ounces of developer to develop six half-plates; and after a development lasting for half an hour the developer would be so oxidized that it would not be advisable to use it a second time; so that the claim of economy can scarcely be justified. It must also be remembered that in dealing with stand development we cannot go away and leave the plate to develop itself for an indefinite time any more than one can with an ordinary development. If a plate would require 3 minutes in an ordinary developer, and 30 minutes to give the same result in a stand developer, then if it were left for an hour in the stand developer it would be just as much spoiled as if it were left for 6 minutes in the ordinary developer; so that it is essential with stand development to know the time which the development will take.

Fog

"Another point to which we wish to call attention with stand development tanks, relates to the defects arising from general fog, and from edge markings, on plates developed in these tanks. A plate during development is peculiarly susceptible to fog, as much so as at any period of its existence, and particularly to chemical action, so that the long development time of a stand-developed plate always tends to produce a danger of fog. In tanks made of zinc, the zinc may not only be attacked by the chemicals used, but may itself also fog plates. All bad air, fumes of burned gas, stagnant water, and the multitude of chemical impurities in the air and solutions of a badly ventilated and not always thoroughly clean dark-room, will unite to attack plates which are soaking in a developer, whilst tanks which are also used for the purpose of fixing, are always liable to the suspicion of hypo contamination. It may be pointed out that the developers given here contain no bromide. The addition of a small quantity of bromide will generally diminish any slight trace of fog, but when using bromide it must be remembered that for moderate amounts of bromide the time of development should not be altered, but the time of exposure must be increased: that is to say, a plate which is to be developed in a bromided developer will require a somewhat fuller exposure than one to be developed without bromide.

Markings

"Edge markings are frequently accompanied by a lack of gradation in the high lights. The cause of the edge marking and the lack of gradation is the same; it is that in many of the tanks on the market the plates are too close together, and are too close to the bottom of the tank; the result is that the plate is, to a certain extent, starved of developer, so that the development progresses more rapidly in the half-tones and shadows than in the high-lights of the plate, producing a flattening of the high-lights; while the marking on the lower edge is caused by the solution of the backing, which falls to the bottom of the tank and accumulates on the lower edge of the plates, the backing from one plate affecting the face of the plate immediately behind it. This can be to some extent prevented by placing all plates face to face and back to back in pairs in the tank."

Time Development Vindicated

The reply to Messrs. Wratten, was published in the *British Journal of Photography*. It is from the pen of Mr. Alexander Mackie, who incidentally states the case for time development in a very common-sense way.

"The economy of the system is impugned on the ground that 'the tanks made for this purpose, ingenious and convenient as they are, require a very large quantity of developer.' Presumably it is intended to say, they require an unnecessarily large quantity, and it is the fact that the commercial articles generally do. But that goes to prove that the tanks are really neither 'ingenious nor economical.' The fault is with the tanks therefore, and not attributable to the system. But according to Messrs. Wratten's measurements the quantity employed in 'one of the smallest' of the comme tanks constructed for six half-plates is 29 ounces, say ounces to make a round number, and as throughout the paper a solution consisting of a normal developer diluted ten times is given as typical, and therefore the equivalent amount of normal developer for six half-plates would calculate out at three ounces, it can hardly be conceded that they have made good their case against economy.

"It seems more than possible that Messrs. Wratten have used the expression 'stand development' in a limited and somewhat misleading sense, without realising that they have done so. The context of their papers shows that they regard stand development as essentially connected with the use of extremely diluted developer. It does not necessarily mean anything of the kind. The objects of the method of placing the plates upright in a rack are, primarily, two: in order to save the table space required when a number of dishes are used, and in order to prevent the mottling that frequently occurs when plates are developed in dishes without constant rocking. A more dilute developer than usual is generally, but not necessarily, employed, but the precise strength of the developer is very much a matter of personal convenience. A developer that acts too quickly to allow the plates to be removed from the tank without risk of showing a marked difference in the stages of development between the first and the last is naturally not a convenient one, while, on the other hand, a developer that requires an hour or more is likely to cause inconvenience in another direction. Probably the balance of advantage will be found in arranging for development to take from 15 to 30 minutes. This will not involve extreme dilution of the developer, and thus the risk of those troubles arising, which Messrs. Wratten have referred to as incidental to the method of development, will be reduced, and with a really ingeniously designed tank the cost of the developer will still be well under that required with the ordinary tray method. The tank arrangement should preferably be a rack closely fitting into a tank, and so constructed that, while sufficient space was left between the plates, where the developer is required, no unnecessary space is left elsewhere. This arrangement is especially convenient from the facts that the operations of fixing and washing can be carried out without transferring the plates from the rack in which they were held for development, thus minimising the necessity for handling them while wet, and that the plates can be removed from the tank and the developer stirred from time to time if necessary.

"It is to be gathered that Messrs. Wratten's deprecatory attitude towards stand development arises from their having approached the subject from a particular point of view, that point of view being that some system of development based upon the calculation of the time occupied is the only desirable or correct method to employ. It is perhaps a natural point of view for the plate-maker to take, and it must be conceded that for plate-testing it is useful, and in some special applications of photography a time system is the only system possible. But because dilution of the developer upsets or renders more difficult the application of the time it takes to complete development it does not follow that the employment of dilute developer is either unscientific or undesirable. The majority of photographers do not practise any timing method. They cover their plates with the developer and take them out when, according to their judgment, development has reached the proper stage. In using stand development they do the same. The time occupied is longer. It is purposely arranged to be so, but as in either case time is not a matter of consideration, it is only a matter of convenience and not of necessity to know even approximately how long development will take. It is interesting to learn that the time of development increases out of proportion to the degree of dilution of the developer, and that the proportion further differs with some developers according to the amount of air in the water, but the knowledge of these facts, which seem to Messrs. Wratten to have so important a bearing on the utility of the stand method of development, is really of quite minor importance except from the particular standpoint from which they view the position.

"In concluding their paper Messrs. Wratten deal with tank markings and fog, and here they give a lugubrious list of pitfalls to be encountered, and it must be admitted that their list is not complete.

"It is hardly conceivable, for instance, that the air of a dark-room that one could breathe without discomfort could be sufficiently bad to affect appreciably the whole of a solution in a tank seven or more inches deep in the space of time that development occupies. That there are certain precautions necessary to be observed in adopting the stand method just as there are in the ordinary method and that the neglect of observing these precautions under any circumstances is likely to affect results injuriously is axiomatic. It is well to point out what these precautions are, and in doing so general terms were sufficient, but it was unfortunate that general terms were maintained throughout the paper. To say, that the use of pyro-ammonia as the developer will cause green fog as a general statement is not true, but to apply the same statement specifically to a certain plate, or more broadly, to add, with some plates, alters the position entirely. It is reasonable to suppose that Messrs. Wratten intended their depreciation of the system to apply to its employment with their own plates, but they do not say so. They mention, incidentally, a particular variety of their plates, but that is only in connection with time calculations. The omission was probably an oversight, or was thought unnecessary in a communication addressed to users of their plates, but its effect is to reduce much of what they say to the level of the general statement concerning pyro-ammonia as above illustrated. That is faulty from want of specific application. The plate is a most important factor, and the behaviour of a particular plate under conditions of normal development, and the quality of the results thus produced are no guide whatever to what it will do under the modified conditions of stand development. Some good plates behave badly under stand development, especially with extremely diluted developer, just as some good plates behave badly with pyro-ammonia. That it is so does not imply a general condemnation of the plate, but knowledge of the fact broadens out the scope of an enquiry into the theory and practice of stand development immensely."

I cannot enter into the reasoning which prompted Messrs. Wratten to discount the practical value of time development. It is probable that they will find occasion to amend their views on the subject. But Mr. Mackie's rejoinder is of such value, not only in destroying Messrs. Wratten's objections, but as indirectly defending the system from the attacks of the thoughtless superficialist—there are, alas! many such in photography—and as anticipating the objections of iron-bound conservatives in the matter of development, that I think its inclusion in these pages quite desirable and justified.

Apparatus

Porcelain and metal tanks suitable for time development are, as I have said, already on the market: and the reader by a consultation of the commercial announcements in the press will find that he has a tolerably wide choice of selection. I myself in the pre-time and temperature days used grooved porcelain troughs: today in the new conditions of things, grooved metal rack tanks; dipper tanks and other forms are in favor. But tank apparatus is in course of evolution. In the following pages the available tanks are briefly described. Other forms are, however, imminent for introduction to the market and after another year's working we may expect to see many additions to the resources of the tank development worker. With characteristic enterprise the Eastman Kodak Company have met the need of the film photographer desirous of adopting the tank system of development by introducing a piece of apparatus specially designed for his (or her) use. To this tank developer, I venture to think, the newest system of development traces a very great impetus.

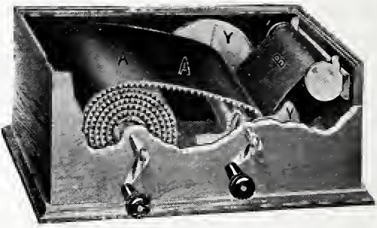

FIG. 1

The Kodak System The kodak tank is made in three sizes —3½ inches, 5 inches and 7 inches in width of spool capacity: all sizes of film from the Brownie up to the No. 5 Cartridge Roll Holder Cartridges thus being provided for. The apparatus consists of a wooden box, a light-proof apron,. a transferring reel, a metal solution-cup with cover, in which the film is developed, and a hooked rod for removing the film from the solution. The axles C. and D. (Fig 1), having been placed in position, one end of the apron is attached to the spindle, through which axle C passes, by means of metal hooks, which are engaged with lugs on the spindle. The entire apron is wound on the spindle. The film-spool or cartridge is inserted at B, and the black paper threaded underneath a wire guard on the transferring reel D, and the axle is turned until the word "stop" appears on the black paper. The apron is then hooked to lugs on the transferring reel in the same manner that the opposite ends were hooked to lugs on the spindle. The box being covered, axle D is slowly and steadily turned until black paper, film and apron are rolled up together on the reel. The box being now uncovered axle D is drawn out, the hand holding the apron and black paper, so as to keep the end of the apron from loosening. Then the entire reel, containing apron, black paper and film are inserted in the solution-cup (Fig. 2), containing the developer. The cup has a cover. The total length of time for development is 20

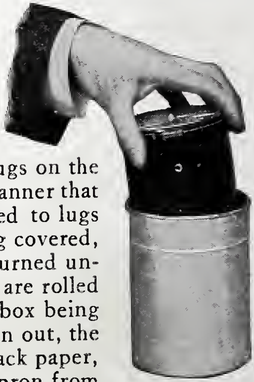

FIG. 2

minutes. In Fig. 1, AA indicates the apron and Y the flanges of the transferring reel. Besides issuing minute directions for development with this ingenious tank, the Eastman Kodak Company, in a descriptive pamphlet give formulæ for 20-minute, 10-minute and short development, and add many other details bearing on the subject. A daylight developing box is also supplied for use with the Brownie series of cameras. This is a light tight metal box provided with a pair of rollers actuated by an external crank by which, while one end of the film is held at one end of the box, the rest is unwound, passed round a roller at the other end of the box, and so back to the starting-point. The film thus makes a single loop in the box, and the developer which is poured in before the film is wound, reaches every part of the film without hindrance.

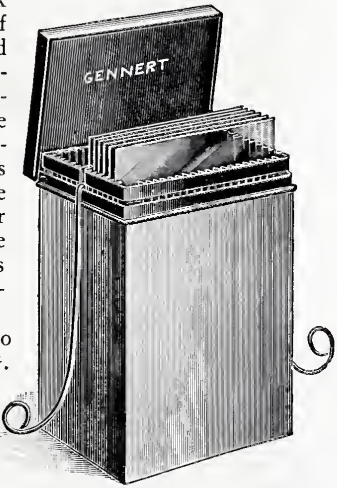

FIG. 3

Auto Tank

The "Auto Tank" (G. Gennert, New York) was the first developing tank introduced in America. It consists of an oblong zinc box with cover containing a zinc grooved rack, constructed to carry different sizes of plates (according to the number of the box used) and fitted with hinged metal handles by which the rack is raised, lowered or suspended in the tank. In Fig. 3 we see the rack elevated out of the developing solution so that the plates may be examined. This rack serves several purposes, as it can be stood in a pail of water for washing the negatives, and as a drying-rack after the negatives have been washed. The plate user, therefore, should find the "Auto Tank" of varied service in his development work.

Eagle Adjustable Tank The "Eagle Adjustable Developing Tank" (George Murphy, Inc., New York,) is made in two styles: zinc, and nickle-plated, the former being used for development only. It consists, as seen in Fig. 4, of a grooved rack taking plates of various sizes, according to the capacity of each tank, each rack holding 12 plates—although it is advised that not more than six plates be developed at one time, as the handling of plates closely packed back to back in narrowly separated grooves is not an easy task to inexpert fingers. A shut over lid and a spout for the admission of the developing fluid are features of the tank. In Fig. 5 we have the "Eagle Film Carrier," which makes tank development available for Filmpack and other flat films.

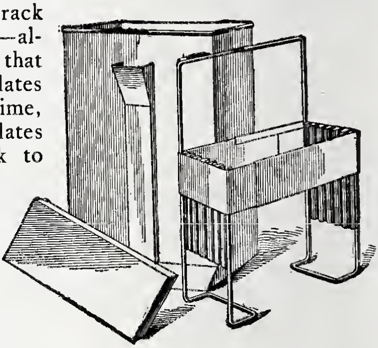
FIG. 4

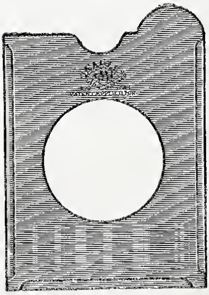
FIG. 5

Ingento Tanks The Ingento Tank, style B, Fig. 6, (Burke & James, Chicago,) is constructed of heavy zinc, fitted with wide grooves and with a lifting bottom which allows the negatives to be removed without the fingers coming into contact with the solution. These tanks cannot be used for fixing purposes. Style A, Fig. 7, tanks are made of brass, nickel-plated, and are fitted with a wide-groove removable rack to hold the plates separate in a vertical position. These tanks have six grooves. Outside each tank and extending to the bottom is a screened light-tight tube by means of which the tank is filled, through a funnel, with the developer in the daylight. These nickeled tanks are, of course, available for developing, fixing and washing plates, thus making it possible to carry the negatives through these operations without handling or transferring to separate baths. By means of the Ingento Film Carrier, recently introduced, the system is extended to include all kinds of flat or cut films.

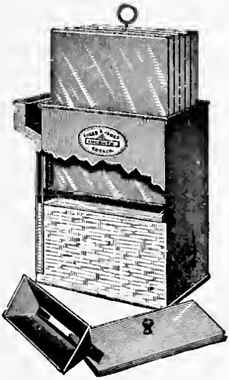
FIG. 6

A Reversible Tank

Messrs. Burke & James are also placing on the market a new tank which comprises an inner light-tight tank fitted with the usual plate-rack, and a larger, outer tank which holds the developing solution. Although the apparatus, which is made of brass, nickel-plated, is complete as here described, and may safely be used for fixing and washing as well as developing the plates, it is advised, for greater convenience, to have two outer tanks, the second one being used for fixing and washing only.

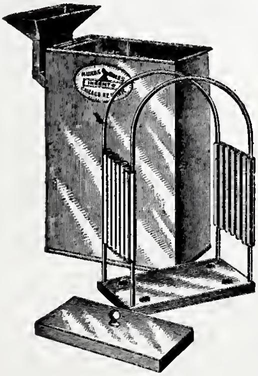
FIG. 7

In practice we have found this double tank a great convenience. The inner tank chamber, with its rack, can be filled with exposed plates in an Ingento changing-bag or dark-room. It is then closed with a tightly-fitting lid provided with fasteners at each side, and is immersed in a pail of clean water, so that the plates are rinsed before development. The tank is now lowered into the large tank containing the developing-solution and left for half the development period, after which it is removed and reversed; this reversing the plates end for end is the special feature of the apparatus. When the time of development is completed, the inner tank is removed from the outer tank and dipped into a pailful of water to rinse the plates, and then placed in the fixing-solution in the second outer tank or any suitable vessel. After fixing, the rack holding the plates is removed from the inner tank and placed in the outer tank under a tap to wash, all the operations going through smoothly without any handling of the plates. The apparatus is shown in Fig. 8, but its practical points may be better appreciated by examination of the tank itself at the store of a nearby dealer.

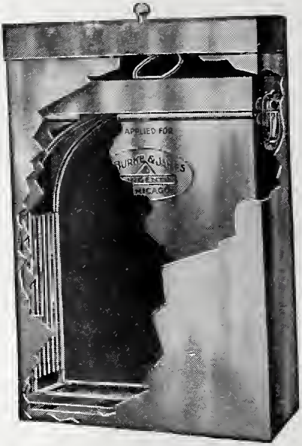

FIG. 8

Merito Tank In the Merito Developing Tank, familiar to our English readers, the plate-holders are suspended from a toothed rack in the tank, and they are so shaped at the top as to enable them to be easily lifted in and out. Being suspended, a rocking motion can be given to the plates. To find out how much solution will be necessary, one need only fill the tank with water, previous to development, when it contains the number of sheaths requisite to take the number of plates to be developed. The quarter-plate size requires forty ounces of solution to develop six quarter-plates.

Standa Tank The Standa Tank, another British introduction, consists of two chambers, an inner one, provided with light-tight lid, for the reception of plates, and an outer one which holds the developing solution. The "Standa" takes six plates. The inner chamber is loaded in the dark-room and the lid is then put on. The tank having previously been filled with developer, the inner chamber is next lowered into the solution.

Rystos Tank

The Rystos Sequential Developing Bath is a third apparatus, the principle adopted being the employment of lifters in a grooved copper tank, sectioned off, as it were into a series of separate baths.

Development

In the old days—those dear old days some of us look back upon with mingled pleasure and regret—development was called an art and science. It is an art no longer, for the personal equation is gradually being eliminated from it. Time development has followed logically upon the factorial system and the Hurter & Driffield investigations to still further discount the value of individuality in dark-room work and so it is that we have got to the point where fractions of time and temperature take the place of "judgment" and "ocular inspection" in the preparation of the negative image. The development section of this PHOTO-MINATURE is necessarily somewhat lengthy because it deals with the kernel of our subject. Typical formulæ for the best known developers are given and their characteristics under time and temperature treatment are brought out. The valuable work of H. T. Munkman in correlating in tabular form, the influence of varying degrees of temperature upon qualitative and quantitative development should be especially studied by the worker and I draw particular attention to the paper by Mr. Gaston M. Alves given in later pages of this issue, in which the relations between time and temperature are set forth in minute and extremely accurate detail.

Kodak Standard Pyro

The pyro developer advised for use in the Kodak Roll-film tank is as follows. For *20 minutes' development* with the 3½-inch tank: Pyro, 22 grains; sodium sulphite (anhydrous), 66 grains; sodium carbonate (anhydrous), 44 grains. Dissolve the chemicals in the order named in 5 or 6 ounces of lukewarm water, then add cold water to fill the tank to the embossed ring. For 20 minutes' development with the 5- and 7-inch tank:

Pyro, 30 grains; sodium sulphite (anhydrous), 90 grains; sodium carbonate (anhydrous), 60 grains. Dissolve in 5 or 6 ounces of lukewarm water, then add cold water to fill the tank to the embossed ring. The temperature of the developing solution should be 62° to 65° Fahr. If crystals are used instead of anhydrous sulphite and carbonate, double the quantities given in the formulæ for these salts.

The formulæ here given make up what is known as the Standard Solution for the Kodak Tanks, identical with the powders sold by dealers for this use. By doubling the quantities of all the chemicals named and dissolving in the same bulk of water a double strength standard solution is obtained, suitable for *10 minutes' development* with the tank.

Variations for Emergencies

It sometimes happens that, owing to conditions uncontrollable at the moment, it is not possible to secure and maintain the standard temperature of 65° Fahr. when using the Kodak Tank and the Standard Pyro developer. Countless experments have demonstrated that 65° Fahr. is the most practical temperature for development when the time of development and proper density of the film negative are considered. This temperature is, under normal conditions, easy to maintain, and does not prolong development unduly.

The relation of time of development and temperature of developer is most important, and is the foundation of success with tank development. That one may, within certain limits, depart from the standard temperature of 65° Fahr., and by lessening or prolonging the time of development, secure good results, is evident. It is not advisable, however, to depart from standard time and temperature except in cases where normal conditions do not obtain.

As a guide in emergency cases, we extract from the manufacturer's recently published instructions the result of a series of tests that are sufficiently accurate for all practical purposes.

Standard Developer. Temperature, 65° Fahr.
Time of Development, 20 Minutes

TEMPERATURE	TIME OF DEVELOPMENT
70 degrees	15 minutes
68 "	17 minutes
65 " normal	20 minutes
60 "	25 minutes
55 "	30 minutes
50 "	35 minutes
45 "	40 minutes

Double Strength Standard Developer. Temperature,
65° Fahr. Time of Development, 10 Minutes

TEMPERATURE	TIME OF DEVELOPMENT
70 degrees	8 minutes
68 "	9 minutes
65 " normal	10 minutes
56 "	13 minutes
50 "	15 minutes
44 "	17 minutes

The developer must never be warmer than 70° Fahr. It will be noted that it requires just double the time for development between 65°, the normal temperature, and 45° when using one powder, and nearly double the time when employing double-strength developer. The variation in the temperature of the atmosphere will make some difference in the results, but not sufficiently so to be taken into serious account. At low temperature some difficulty may be experienced in dissolving the developing powders; crushing the powders very fine and adding slowly to the water while stirring will lessen this difficulty.

Always, when possible, stick to normal temperature and time, as they naturally tend to simplify the obtaining of good results.

The above tables, showing the wide variation in time necessary to obtain proper density at different temperatures, will fully demonstrate the important part temperature plays in the science of tank development.

Wallace's Formula For professional or commercial use, where quantities of plates of large sizes are to be developed by the tank method, the following pyro formula, given by Mr. W. H. Wallace, will be found reliable and convenient. Make up stock solutions as here given:

Stock alkali solution.—Water, 24 ounces; sodium carbonate (dry), 1 ounce; sodium sulphite (dry), 1 ounce. Stock pyro solution.—Water, 9 ounces; oxalic acid, 12 grains; pyro, 1 ounce; add water to make the bulk of the pyro solution up to 10 ounces. To develop, take: Alkali solution, 6 ounces; pyro, ½ ounce.

For the working developer, dissolve 2 ounces of sodium sulphite (dry) in two gallons of water and to this add 20 ounces of stock alkali solution and 4½ ounces of stock pyro solution. This gives ¾ grain of pyro and 1½ grains of alkali in each ounce of developer, resulting in negatives of normal density with twenty minutes' development at 60° Fahr.

Munkman on Pyro

The following formulæ and method, recommended by H. T. Munkman (*Focus*, July 10, 1907,) as the outcome of considerable experience with pyro in tank development, have proven well adapted for use with American plates. The negatives are soft, with just sufficient "pyro stain" to add to their printing quality, very suitable for portraiture or enlargement. Where greater contrast is desirable, as in architectural or commercial work, or for carbon or platinum printing, this is easily secured by doubling the quantities of solutions *A* and *B* advised below, the amount of water added to form the developing solution remaining unchanged as given.

A stock solution of pyro is first prepared as follows: Dissolve ¼ ounce of potass. metabisulphite in 10 ounces of water, and in this dissolve 1 ounce of pyro. Well stoppered, this solution will retain its qualities indefinitely.

The two working solutions are best made up a few hours only before use, as follows: Solution *A*.—Pyro stock solution, 1 ounce; water, 10 ounces. Solution *B*.—Sodium sulphite (crystals), 1 ounce; sodium carbonate (crystals), ½ ounce; water to make the solution up to 10 ounces. Solution *B* will keep in good working condition for a week or two, but is liable to give stain as it ages.

For use, solutions *A* and *B* are combined and varying quantities of water added, according to the time of development or degree of contrast desired. The following table, given by Munkman, will enable the reader to make up a developing solution proportioned according to the capacity of his tank and other individual requirements:

Temperature and Time of Development, 65-70° Fahr. 25 Minutes

Solution A, 1 part . . .	60–65° Fahr., 30 minutes
Solution B, 1 part gives .	55–60° Fahr., 40 minutes
Water, 8 parts	50–55° Fahr., 50 minutes

Care should be taken to mix thoroughly the developing solution before use by stirring or by pouring the solution from one vessel to another.

Harris on Pyro

When there is a large number of negatives to develop, and limited time in which to do it, Mr. G. T. Harris, from whom I have already quoted, chooses stand development as the most convenient and expeditious for the work. The exposures may range from $\frac{1}{100}$ of a second to several minutes, the subjects including both landscape and architecture. Three dipping-baths are used, each containing 40 ounces. The formulæ is: Pyro, 20 grains; sodium sulphite, 120 grains; potassium metabisulphite, 30 grains; sodium sulphite, 240 grains; water, 40 ounces. The plates develop with great regularity and steadiness, and, while the bath is fresh, are transferred after rinsing to an acid-fixing bath, their color being of a neutral grey. As the bath oxidizes, color begins to manifest itself, and then the plates after development are placed for some minutes in a ten per cent bath of sodium bi-sulphite. When the baths begin to work slowly, they are renewed by the addition of sulpho-pyrogallol and carbonate—half a grain of pyro and its preservative and six grains of carbonate to each half plate. For reproduced negatives the strength of this formula may be doubled. The time of development averages five minutes at about 60°. To secure uniformity in working, the temperature is kept constant: in winter a bath capable of holding the dipping-baths, and a sufficiency of water at a temperature of 60° Fahr.

are used. He finds that discolored pyro is no obstacle to the production of unstained negatives if the acid sulphite bath is used between development and fixation, care being taken to replace it with fresh solution when it becomes discolored. The use of the pyro freshly prepared, prevents the non-staining of the negatives. In this use of freshly prepared pyro, there is a valuable suggestion which the reader should note.

Cramer's Pyro-Acetone

A pyro-acetone developer that works quickly and uniformly without frilling, and that can be used in a warm climate without staining the hands, is made in three solutions: A, pyro, 1 ounce; oxalic acid, 12 grains; water, 16 ounces; B, Cramer's liquid acetone, 4 ounces; dry sodium sulphite, 2 ounces (or 20 ounces sulphite solution 48° hydrometer test); water, 20 ounces. For use take A, one ounce; B, 2 ounces; water, 30 ounces. The use of acetone seems to make the developing solution less sensitive to temperature changes, hardening the film at the same time, thus obviating any liability to filling.

Cramer's Pyro

In recommending the following pyro formulæ for tank development, the G. Cramer Dry Plate Company draw attention to the fact that there is a point beyond which the developer cannot be safely diluted without causing peculiar streaks and blotches and stain and fog, due to the solution decomposing before development is complete. Such effects are producible if the developer is too old, as in that condition it works unevenly. A previous soaking of the plate in water may prevent the appearance of these markings, although more obvious remedies are the use of a less dilute developer, or the substitution of an entirely fresh one. A, pyro, 1 ounce; citric acid, 20 grains; dry sodium sulphite, ¼ ounce; water, 16 ounces. B, dry sodium sulphite, 2 ounces (60° by hydrometer); water, 16 ounces; dry sodium carbonate, 2 ounces (60° by hydrometer); water, 16 ounces. For immediate use, take of A, 1 ounce; B, 1 ounce; C, 1 ounce, and water at 50° Fahr., 50 ounces.

Six-minute Pyro

A six-minute developer: Dry pyro, 14 grains; sodium sulphite, 80 grains; sodium carbonate, 55 grains; water, 8 ounces. If this solution is used at 65° Fahr., the plates should be immersed in it for six minutes.

Twenty-minute Development A twenty-minute developer: Solution A: pyro, 1 ounce; oxalic acid, 10 grains; water, 16 ounces. Solution B: sodium sulphite, 2 ounces; water, 16 ounces. Solution C: sodium carbonate, 2 ounces. In use take one ounce each of A, B and C, and 35 ounces of water.

Tabloid Pyro Tabloid pyro may be used with good results. Take tabloid pyro, one tabloid, water, 4 ounces; tabloid pyro accelerator, one tabloid, water, 4 ounces; made up in solution to a bulk of 20 ounces, with a few drops of a 10 per cent solution of bromide of potassium added. This gives a very dilute solution and takes from fifteen to twenty minutes to develop.

Glycin Several years ago, Dr. Malcolm D. Miller, made some careful comparative tests of different developers, settling at length on a special pyro formula for dish development. Glycin proved even better in some of its properties, but somewhat slow, except in combination with metol to accelerate development. The prominent advantages of glycin are: (1) Absolute clearness in working without bromide; (2) freedom from stain, the deposit being a good black; (3) extreme fineness of grain in the deposit, and (4) printing quality. Accordingly, Dr. Miller began experimenting with glycin and an ordinary japanned metal fixing tank. The results were so good that he put through two batches each of six dozen whole-plate landscape negatives. The exposures were all nearly normal, and he got a very fine set of pictures, many of them far better printers than would have been the case if pyro had been used. The imperfections of the box, however, made the process a bother, and he therefore endorses the advice to get a good tank with a removable rack. It is more convenient to be able to load the rack in front of the lamp than to grope round in the murk trying to get the plates into the proper grooves, only to find that some are in "kitty-cornered" and the capacity of the tank reduced; to say nothing of lifting single plates to break air-bubbles. Last winter he was able to do his work in making medical photographs solely by using the tank. By the tank method he can finish each day's negatives without interference with other duties. Six or eight plates are developed at one time, transferred to a zinc washing-tank full of water, covered, and carried out to the sink, where the water is allowed to run through for several minutes. The cover is then removed, and the plates transferred in daylight to the fixing tank.

The washing after development is an absolute necessity with glycin, since if it is omitted very bad yellow stains occur when the plate touches hypo. As a rule, the second batch of developed plates is ready to be rinsed by the time the fixed plates should be taken out for the final washing. The formula is: Hot water 5 ounces; sodium sulphite (anhydrous) 140 grains; sodium carbonate (dried) 140 grains; glycin 280 grains. The chemicals are dissolved and made up to eight ounces with water. This forms the stock solution.

The stock solution is diluted for use by adding to each ounce of it thirty-two ounces of water. The dilute developer may be used repeatedly if kept in a well-corked bottle when not in use. The temperature should be as near 50° Fahr. as possible. In summer it is necessary to pack the tank in ice. The plates are examined every fifteen minutes. Over-exposures of moderate amount develop in fifteen minutes, normal exposures in twenty-five to thirty-five minutes, while under-exposures may take several hours. But, in any case, if the plate is taken out at the right time, whether that time is fifteen minutes or fifteen hours, the weak glycin according to Dr. Miller's experience, will give a better printing negative than any other developer.

Waugh's Glycin Formula

In single solution form glycin may be used in the following manner, according to Mr. F. A. Waugh. Take hot water, 1 ounce, and dissolve therein glycin, 10 grains. Then add sodium sulphite, 10 grains; potassium carbonate, 10 grains, and, when quite dissolved, add water, 9 ounces. The development takes from half an hour to one hour and should not be stopped too soon as the negative loses density in the fixing bath.

Paramido-phenol The following formula is due to Mr. Milton B. Punnett, who gives it in *The American Annual of Photography* for 1908. Paramidophenol, 25 grains; sodium sulphite (dry), 60 grains; sodium carbonate (dry), 60 grains; water (65° Fahr.), 36 ounces. Development to take twenty minutes. The paramidophenol should be dissolved first. If the sulphite and carbonate are mixed thoroughly, they dissolve quicker for the reason that the sulphite keeps the carbonate from caking. This is a clean working developer and in Mr. Punnett's experiments gave as clear, if not clearer, negatives with old films than pyro. Using two powders and the same amount of water, will give a solution which will develop in ten minutes or a little less time if negatives of the same density as the twenty-minute development gives are desired. More than one roll can be developed with one powder if care is used not to waste any of the solution. This includes allowing the roll when taken from the tank to drain into the solution. To facilitate draining, hold the roll at an angle and it will drain practically free in about fifteen seconds. Mr. Punnett has developed successfully three rolls—six-exposure film with one powder made as above. The first was developed twenty minutes, the second, twenty-five minutes, and the last, half an hour. At the finish, the developer was not very much discolored and the negatives were a good blue-black color.

Microgen The formulæ for microgen, introduced by Mr. Ralph Martin, is available for all varieties of tanks. It reads: microgen, 60 grains; potassium metabisulphite, 24 grains; sodium sulphite, dry, 60 grains; sodium carbonate, 80 grains; water, 40 ounces. The metabisulphite and the sodium sulphite should be dissolved in 4 ounces of of water, and then the microgen added to the solution thus made. Then having dissolved the carbonate in another 4 ounces of water, the latter is mixed with the former and the balance of the water added to make up the complete solution. The color of the negative that microgen gives comes between the blue-black of amidol or metol-hydrokinone and the brownish tint of the pyro-negative. It is a good black that has a suspicion of warmth in it. It is not so rapid in its action as metol, nor so slow as glycin.

Adurol Adurol, 50 grains; sodium sulphite, (crystals), 150 grains; sodium carbonate, 150 grains; water, 100 ounces. Development should be carried on for twenty-five minutes or until the desired density is attained. This developer is very little affected by temperature — it works very evenly in both hot and cold weather.

Metol-Adurol The metol effect in negatives is obtainable by the following combination: Water, 4 ounces; sodium sulphite (anhydrous), 300 grains; potassium bromide, 15 grains; adurol, 105 grains; metol, 15 grains; potassium carbonate, 750 grains. Each ounce of this stock solution is diluted for use with 16 ounces of water.

Ortol Sometimes the worker may not be in a position to prolong the operation. Perhaps he has been on a holiday, and has a few exposed plates which he is anxious to turn into negatives in a comparatively short time. The following ortol formula will enable him to develop a few plates in a tank in approximately half an hour. Ortol, 10 grains; potassium metabisulphite, 5 grains; sodium sulphite, 65 grains; sodium carbonate, 65 grains; water to 20 ounces.

Rodinal Because of its convenience as a concentrated developer simply requiring dilution with water for use, its freedom from any tendency to stain or fog the negative, even in prolonged development, and its remarkable elasticity in giving any desired degree of contrast by varying the strength of the working solution, rodinal is peculiarly adapted for time and tank development.

The official formula for the use of rodinal as a tank developer is: Rodinal, 1 part; water, 40 parts. This, at the normal temperature of 65° Fahr., gives a negative of good average density with twenty minutes' development. Here, however, as with every other developing solution of given strength, used at a given temperature for a given time, the amount of contrast secured in the negative will vary with different brands of plates, and, even with any one plate, may not wholly satisfy the requirements of the individual worker, or be suited to the particular printing process to be employed. Taking the formula as suggestive, a trial development or two will indicate the variation of the proportions or the time of development required to get the results desired. In my own practice, for example, I use a solution of rodinal 1 to 100, with twenty minutes' development at 20° C. (68° Fahr.). This, with the plate I use, gives the soft, detailful negative I prefer for development papers. For crisp negatives, to be printed in carbon or platinum, I change the proportions and use rodinal 1 to 40 at the same time and temperature, this variation giving me the difference in contrast desired.

It should not be forgotten that negatives developed with rodinal lose somewhat in fixing, so that the development should be carried sufficiently far to allow for this. The complaint sometimes heard that rodinal gives flat negatives, lacking vigor and printing quality, invariably arises from neglect of this detail. Be sure to carry the negative far enough in development and rodinal will give all the sparkle and vigor obtainable with any other developer.

The advantages of rodinal, as well as the variation of the time of development to secure the range of contrast desirable with different classes of subjects, have received more attention in Europe than on this side of the Atlantic. Thus, H. T. Munkman (*Focus*, Aug, 14, 1907), gives the following table for time development with rodinal 1 to 100, at different temperatures and for the three chief classes of subjects. He suggests that a five per cent solution of sodium sulphite may be used in place of water for the dilution of the working developer, but this is not essential. In ordinary everyday practice development does not usually take place at a lower temperature than 60° F.—at any rate it should not—so that the table between 60° and 65° contains the data mostly required by the occasional worker. Above 65° and below 60° abnormal conditions of temperature are dealt with: and a possible field for further experimental effort indicated.

Temperature in Fahrenheit Degrees	Development in minutes and seconds		
	Portrait	Architecture	Landscape
72	14	19·30	27·20
71	14·30	20	28
70	15	20·30	28·40
69	15·30	21	29·20
68	16	21·30	30
67	16·30	22	30·40
66	17	22·30	31·20
65	17·30	23	32
64	18	23·30	32·40
63	18·30	24	33·20
62	19	24·30	34
61	19·30	25	34·40
60	20	25·30	35·20
59	20·30	26	36
58	21	26·30	36·40
57	21·30	27	37·20
56	22	27·30	38
55	22·30	28	38·40
54	23	28·30	39·20
53	23·30	29	40

Apart from the time development of negatives, rodinal is one of the best developers available for the tank development of lantern slides and transparencies. The make-up of commercial lantern plates varies so widely that it is impossible to give a formula which is adapted to all makes, but I find that rodinal 1 to 40, used with Seed's black-tone lantern plate gives a clear, brilliant slide in 12 minutes at 65° Fahr. For the Barnet C. G. lantern plate, I use rodinal 1 to 100, time 5 minutes at 65° Fahr. These variations are readily determined by experiment, the point to be emphasized being that once we know the time and temperature which will give the desired results with a given formula, the process of development by tank is the simplest and surest way to success.

Spots and Their Remedy

As in the older method of tentative or tray development, spots make their appearance on the negative when the time system is in operation. Occasionally a whole batch of negatives will show little black spots that cannot be removed, and the cause of which has puzzled some clever workmen. Investigation has proved that these spots were caused by minute undissolved crystals of the reducing agent used in the developer. These are so small and so transparent, as to be extremely difficult of detection by the naked eye, even when their presence is suspected. These crystals floating in the tank become lodged on the softened gelatine, and naturally an extreme over-reduction takes place, forming the little black spot referred to. Were the same developer used in the ordinary manner in a tray, the constant agitation given it by the usual rocking keeps the undissolved crystals in suspension, and that is why we do not meet with this trouble of spots ordinarily. The remedy for the trouble is, of course, simply to use only the most soluble reducing agents for time development, or, if others are used, they should be prepared a considerable time before they are required, and also the stock solution must be far less concentrated than is necessary in the case of the more soluble agents.

Uneven Density and Development Marks

One well-known worker finds that uneven density of the solution appears to occur most frequently with rodinal when it is not exceedingly dilute. Workers have complained that in extreme cases it gives them negatives denser along the lower half, and necessitates the inverting of the plates when the time of development is half over. Gentle shaking of the porcelain tank does not seem to have much effect, besides which a nearly cube-shaped tank is not an easy vessel to rock in such a way as to distribute the contents evenly. Stirring sometimes needs to be resorted to. Development markings are sometimes produced by the grooving of the porcelain, such marks being more likely to occur when a fairly strong solution is employed. These marks may be caused by minute traces of alkali or hypo absorbed by the porcelain through fine cracks in the glaze, the developer dissolving out such traces which would accelerate development, and so produce streaky patches of greater opacity. Obviously, the tank should be as free from imperfections as possible, and should never be used for anything but the one purpose.

Timing the Developer

A contributor to the literature of the subject gives the following rough and ready method of "timing" any developer which one might wish to employ in time development tanks. Ascertain by experiment the time required by the normal developer to give good density with a fairly correct exposure. Let us assume this to be 5 minutes. If we take one ounce of the normal developer, and add to it 1 ounce of water, we have a developer of half the normal strength, and therefore, such a developer would require 10 minutes. If we add two ounces of water, we give 15 minutes development, and so on. Conversely, if our tank holds 20 ounces of solution, and we wish to employ 4 ounces of normal developer, we arrive at the time of development, as follows :—

$$\text{Five minutes} \times \frac{20}{4} = 25 \text{ minutes}$$

One can, of course, formulate times and dilutions from actual experience, but the above may be taken as a fairly accurate means of arriving at the desired data.

Uniform Results in Time Development

BY GASTON M. ALVES

There is no question that uniform strength of solution, uniform temperature and uniform time of development, will produce negatives which will give uniform prints; but the inexperienced will frequently err in these conditions without realizing it. Should the temperature of the developing solution be first taken, and then poured in on the plates, when the plates are of quite a different temperature, then the temperature of the solution in the tank will speedily vary from that as taken. Or if there is a great difference between the temperature of the room and that of the solution, the results will be uncertain. Also, chemicals of the same names, but of different makes, or even of different lots, will often vary in their action.

If the worker in time development will observe the following details, he will get uniform and satisfactory results from a very wide range of exposures:

(1) Do not work under conditions in which the temperature of the room varies more than about 16° Fahr. from that of the developing solution.

(2) Do not employ a solution of higher temperature than 72° or lower than 60°. Aim at 66°.

(3) Place the plates in the tank and pour in the developing water. Let stand for 2 minutes, pour out the water, add to it the developing chemicals, take the temperature of the solution, and then pour back in the tank.

(4) During development, keep the tank covered, and also cover all with a light box.

(5) When fresh chemicals are purchased, make a new test for the proper time.

In time development it is advisable not to make your solutions so weak as to require more than about 20 minutes, or so strong as to take less than about 10 minutes, to complete the development. The temperature being confined within 60° to 72° as advised, the following table will furnish a sliding scale for the time within those limits:

Deg's	Minutes																
60	13	13½	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
61	12½	13	13½	14	15	16	17	18	19	20	21	22	23	24	25	26	27
62	12	12½	13	13½	14	15	16	17	18	19	20	21	22	23	24	25	26
63	11½	12	12½	13	13½	14	15	16	17	18	19	20	21	22	23	24	25
64	11	11½	12	12½	13	13½	14	15	16	17	18	19	20	21	22	23	24
65	10½	11	11½	12	12½	13	13½	14	15	16	17	18	19	20	21	22	23
66	**10**	**10½**	**11**	**11½**	**12**	**12½**	**13**	**13½**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**
67	9½	10	10½	11	11½	12	12½	13	13½	14	15	16	17	18	19	20	21
68	9	9½	10	10½	11	11½	12	12½	13	13½	14	15	16	17	18	19	20
69	8½	9	9½	10	10½	11	11½	12	12½	13	13½	14	15	16	17	18	19
70	8	8½	9	9½	10	10½	11	11½	12	12½	13	13½	14	15	16	17	18
71	7½	8	8½	9	9½	10	10½	11	11½	12	12½	13	13½	14	15	16	17
72	7	7½	8	8½	9	9½	10	10½	11	11½	12	12½	13	13½	14	14	16

The use of the above table will require little explanation: While 66° for the developing solution may be taken as the standard, it is not always easy or convenient to get that exact temperature. As already pointed out, we may use a range of from 60° to 72°, if we make the proper allowance in time. The table gives this allowance. For instance: Suppose we are working with a solution of such strength that it takes just 18 minutes at a temperature of 66° to properly complete the development, but we find the temperature of our solution to be 62. What time are we to allow for the development? Over 18 minutes and in the line of 62° we find 22 minutes, as the proper time.

The worker in time development should always ascertain for himself the time for development with his particular solution. By actual tests find out the proper time required to get a properly balanced negative. Remember that negatives are not best judged by inspection, but by the prints they produce. Experienced workers can judge reasonably well by looking at a negative, but even with the most experienced, the final judgment can only come from the print. The highest function of a negative is to give the proper contrasts—that balancing of light and shade which is realistic—and no man can precisely foretell from the inspection of a negative, what it will do in this regard when placed in the printing frame. Of course, in making his tests for time, it is not necessary for the worker to have his solution at precisely 66°. Should his solution happen to be 68°, and he gets a good negative in, say 14 minutes, he will find by the above table, that the standard time, opposite the 66°, is 16 minutes, and this time will always be his basis for future work with the same solution.

The table above is computed upon the following basis: Repeated experiments show that within the practical temperatures of development, a rise of 14° Fahr. will decrease the time of development about one-half, and conversely, a fall of 14° will about double the time of development. This natural law offers the means of determining the geometrical ratio in the sliding scale of all of the temperatures. Of course in working out this ratio, small fractions of a minute occur. In the table these were carried to the nearest one-half minute, and will produce no appreciable difference in results. The photographer may work without the table if he will carry in his head, the following: Beginning with 7, the time rises by half minutes to 14, and from 14, by whole minutes to 28. If one uses a basic time of 18 minutes or over, and will never employ a temperature over 70°, both of which are good practice, then all one has to remember is, that for every degree less than the 66, one is to increase the time one minute; and that for every degree more, to decrease the time by one minute.

If the worker is not particular and attentive in time development, he is liable to get unsatisfactory results. But if he is particular, he will get uniformly good results from all usable exposures. At one time I did not believe this to be true, but subsequent examination and experiment have convinced me that it is. The great defect in the old method is that results are judged by density, and not by proper contrasts. It is now a well-established law of development that all usable exposures reach their proper contrasts in practically the same length of time in the developing solution. If taken out then, as they should be, the great exposures will be quite dense, the proper exposures will have proper density and the slight exposures will be thin; and all under the proper printing conditions will give realistic gradations of light and shade in their respective prints. By the old method, where density was the chief consideration, the over-exposures were taken out too soon, and gave dull prints. The under-exposures were left in too long, and gave extreme contrasts, often going into the soot-and-chalk type. It was only the properly exposed plates which gave proper contrasts in the prints.

It will thus be seen why time development will turn out a much larger average of negatives which will give satisfactory results, emphasizing, as it does, the great importance of proper contrasts.

A Universal Developer for Plates, Films and Papers*

BY W. H. WALLACE

The favorable reception given by practical workers to the "time and temperature" method of development with pyro, published in THE PHOTO-MINIATURE, No. 66, has encouraged me to work out a similar method for use with metol and hydroquinone, a combination widely employed by many who will not use pyro, and which has distinct advantages over pyro in that it can be used for the development of bromide and development printing-papers and lantern-slides as well as plates and films. As will be seen, the formula is easily adaptable for tank development, so that it may fairly be described as a universal developer. In short, the method and formula provide a development system meeting every practical requirement in everyday work, giving, with reasonably correct exposures, thoroughly good negatives and prints with minimum trouble or chance of failure.

As used for short-time development of negatives, with one or several negatives in a tray, the method consists of a formula and a table giving the time and temperature at which the developer will give negatives of any desired printing density, the contrast factors being expressed in black-face figures at the head of the table. The time of development is given in minutes and seconds, from one to twelve minutes, according to temperature and the amount of contrast desired. The practical range of temperature is given in degrees Centigrade and Fahrenheit in the two columns at the left-hand of the table.

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Time and Temperature Table for use with Wallace's Metol-Hydroquinone Formula. The time of development is expressed in minutes and seconds:

Temp.		CONTRAST FACTORS									
Fahr.	Cent	1	2	3	4	5	6	7	8	9	10
86	30	Min. Sec.		1 10	1 24	1 38	1 52	2 06	2 20	2 34	2 48
82	28		1 04	1 20	1 36	1 52	2 08	2 24	2 40	2 56	3 12
78	26		1 12	1 30	1 48	2 06	2 24	2 42	3	3 18	3 36
75	24	1	1 20	1 40	2	2 20	2 40	3	3 20	3 40	4
73	23	1 06	1 28	1 50	2 12	2 34	2 56	3 18	3 40	4 02	4 24
71	22	1 12	1 36	2	2 24	2 48	3 12	3 36	4	4 24	4 48
69	21	1 18	1 44	2 10	2 36	3 02	3 28	3 54	4 20	4 46	5 12
68	20	1 24	1 52	2 20	2 48	3 16	3 44	4 12	4 40	5 08	5 36
66	19	1 30	2	2 30	3	3 30	4	4 30	5	5 30	6
64	18	1 36	2 08	2 40	3 12	3 44	4 16	4 48	5 20	5 52	6 24
62	17	1 42	2 16	2 50	3 24	3 58	4 32	5 06	5 40	6 14	6 48
60	16	1 54	2 32	3 10	3 48	4 26	5 04	5 42	6 20	6 58	7 36
59	15	2 06	2 48	3 30	4 12	4 54	5 36	6 18	7	7 42	8 24
57	14	2 18	3 04	3 50	4 36	5 22	6 08	6 54	7 40	8 26	9 12
55	13	2 36	3 28	4 20	5 12	6 04	6 56	7 48	8 40	9 32	10 24
53	12	3	4	5	6	7	8	9	10	21	12

It should be noted that as no two brands of plates will work at the same speed with any given developer, even though they come from the same maker, a trial or two may be necessary to get just the right degree of contrast with this or that brand of plates for different subjects or printing-papers. Thus the individual worker is free to choose among the contrast factors given according to his personal preference or the requirements of the printing method to be employed. In this it is only necessary to remember that the range of opacities (or contrasts) is determined solely by the duration of development; the higher the factor, the greater the opacity or contrast. Once the correct contrast factor with any given plate for a normal subject has been ascertained by trial, it will not be necessary to change the factor except for a special subject or other deviation from normal practice. Obviously, changes in temperature, the only condition requiring attention in this system, may be controlled to a certain extent by slight variations in the length of development. As a guide in the first use of the method, it may be stated that in developing a correctly exposed Seed L Ortho plate, the use of equal parts of the stock solution and water and Factor 5 will give a negative suitable for Special Velox paper.

To prepare the stock solution developer, dissolve sodium sulphite (dry), 4 ounces, and sodium carbonate (dry), 6 ounces, in 100 ounces water; add metol, ¼ ounce, and hydroquinone, ¾ ounce; finally add water to make the solution up to 120 ounces. For general use with the table given, take equal parts of the stock solution and water, or dilute as desired when the action of this normal solution has been noted.

To use this formula for tank development: First, reduce to seconds the time of development desired. Second, reduce to seconds the time which the table shows will give the desired contrast with the full strength solution. Third, divide the first figure by the second and the resulting figure will give the dilution required for the prolonged development. Example: It is desired to use the formula for twenty minutes' development: 20 minutes = 1,200 seconds. The factor chosen is four and temperature 68° Fahr., at which the time of normal development is indicated in the table as 2 minutes and 30 seconds = 150 seconds. Dividing 1,200 by 150, we get 8, indicating that for tank development, giving the desired contrast in twenty minutes, we must take one part of stock solution developer and add seven parts of water. In order to avoid stain the entire bulk of dilute developer used should contain 20 grains sodium sulphite per ounce of solution. To insure this, add 20 grains of sulphite to each ounce of water added to the stock solution. Do not use at a temperature higher than 65° Fahr.

In using the formula for the development of development or gaslight papers, use the stock solution at its full strength for regular papers, and use equal parts of stock solution and water for special papers. To insure clear whites in the prints, add one drop or more of a 10 per cent solution of potassium bromide to each ounce of the stock solution used. To save trouble, we may add 15 grains of potassium bromide to the stock solution when made up in the quantities called for in the formula given. This is sufficient to keep the whites clear in prints, and does not affect the speed of plates, though it will slow development a little — without altering the contrast factor.

Notes and Comment

Photographic record and survey work—the recording of places, types and customs which are fast vanishing before the destructive progress of the world of today,—although industriously pursued by photographic societies abroad, has not received serious attention on this side of the Atlantic, save from a few individual workers in special fields. The remarkable work of Mr. Frederic Monsen among the North American Indians may be cited as an example. Mr. Monsen was the first among photographic workers to recognize the great value of a photographic record of this forgotten and neglected people, whose manners, ceremonies and customs are passing from their lives. By many year's work among the different tribes, living among them and winning their confidence, Mr. Monsen has secured over four thousand negatives, his collection being, perhaps, the most complete ethnographic series extant, recording the historic and religious ceremonies of this people in a superbly interesting way.

A few days ago, we had the pleasure of seeing a small part of the Monsen Collection at the gallery of the Salmagundi Club, of this city. The exhibition comprised about 150 sepia prints, 16 x 20 inches, enlarged from small film negatives. Splendid in technical quality and showing scrupulous care in the inclusion of the scientific and ethnological points, indispensable in records of this sort, the characteristic note of the collection was its pictorial quality. In this regard Mr. Monsen's work seems to us to possess a distinct value over and above the otherwise excellent work of Curtis and others who have followed him in this field.

In an early issue of THE PHOTO-MINIATURE we hope to reproduce a few examples from the Monsen Collection for the information or our readers. Meanwhile, we urge those who have the opportunity to see the collection, which we learn will be shown in Washington and other eastern cities during the next few months.

❧

Writing us in respect of the Lumière Autochrome plate, Mr. J. Horace McFarland says:

"I have just had the wonderful experience of exposing and developing the first Autochrome plate, and I can yet hardly believe the evidence of my eyes.

"For a subject we chose three chrysanthemums, one pink, another white, another yellow. To test the capabilities of the plate we used a deep red background. Figuring for exposure from the Lumière formula, we gave the first plate respectively three exposures in strips, including six, four and two minutes at F 11, the objects being fully half natural size and in a fading afternoon light. On development everything went according to program. The shortest exposure was the nearest right, but all, curiously enough, showed a very delightful image. If I had been making this subject in the ordinary way it would have been almost impossible to have properly lighted the deep green foliage, which was considerably curled up, without over-lighting the white and the bright yellow; yet in the Autochrome result the foliage which had the least exposure is completely and fully exposed, with all the rich variations in the green the leaves themselves have, while the white, which had twice the exposure, is also just about right, and, most wonderful of all, shows perfect shading and gradation, not in any tint of any color, but in the gray characteristic of a pure white flower."

In a further letter Mr. McFarland adds: "So far as we have gone in the few additional subjects made since I wrote you last, the plate 'makes good'. A fruit subject made to include as much color contrast as possible shows marvelously accurate results. We used both yellow and red bananas, an orange, an apple and some Malaga grapes, the latter with the yellowish green and greenish yellow characteristics of a ripe bunch. I am deeply interested in the accurate rendering of high lights. Where the strongest light strikes the satiny sheen of the red banana, for instance, the result is just that satiny sheen on the Autochrome, and not, as it would be under ordinary photographic practice, a rather hard white. All the yellow tones of the grapes are there, with a different form of high lighting, also completely accurate. I am forced to the conclusion that with correct exposure the results are sure to be accurate. When there is opportunity to experiment at a less elaborate cost, methods of developing so as to get a slightly thinner image, making it possible to enjoy the Autochromes other than in a brilliant light, will doubtless come through."

◆

A noted English professional photographer in the person of Mr. Martin Jacolette, of London, died early last month. His work consisted chiefly of high-class society portraiture. Mr. Jacolette filled the office of President of the Professional Photographers Association (London), a few years ago, and his death at the comparatively early age of 58 will be regretted by many friends on both sides of the Atlantic.

◆

Before the members of the American Society of Mechanical Engineers on December 5, Mr. F. E. Ives delivered a lecture on "Colour Photography," in the course of which he reviewed and illustrated the various systems of trichromatics that have been introduced to the public from time to time. A feature of the lecture was the display of a number of autochromes, lent by Mr. Alfred Stieglitz for the occasion.

◆

The Imperial Orthochrome Light Filters for use with the well-known Imperial dry plates, are now obtainable in the United States from G. Gennert, of New York and Chicago.

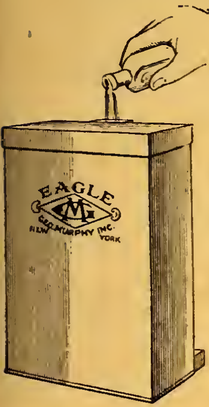
⁂ *Many pages of Notes and Comment are unavoidably held over for No. 85 of "The Photo-Miniature."*

Something New in Developing Tanks

THE

EAGLE ADJUSTABLE DEVELOPING TANK

PATENT APPLIED FOR



The use of this tank does away with all dark-room troubles, making development a pleasure.

No experience necessary to get perfect results.

It has a removable rack which is adjustable to smaller sizes.

Special device for telling when plates are immersed.

No loose parts. The best tank in the market.

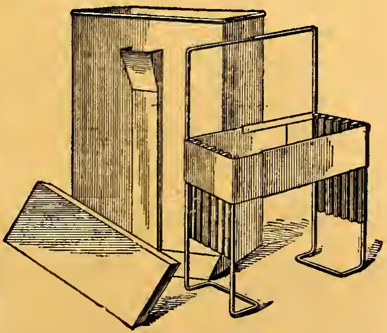
Prices:

ZINC, *for developing and washing only*

No.	Size		Price
No. 1	3¼ x 4¼	and smaller . .	$1.00
2	4 x 5	and smaller . .	1.00
3	5 x 7	and smaller . .	1.50
4	6½ x 8½	and smaller . .	1.75
5	8 x 10	and smaller . .	2.00

NICKEL-PLATED, *for developing, fixing and washing*

No.	Size		Price
No. 6	3¼ x 4¼	and smaller . .	$2.00
7	4 x 5	and smaller . .	2.00
8	5 x 7	and smaller . .	3.00
9	6½ x 8½	and smaller . .	3.50
10	8 x 10	and smaller . .	5.00



Eagle Tank Developing Powders. 6 for 25 cents. Each powder makes 28 ounces, 20-minutes developer

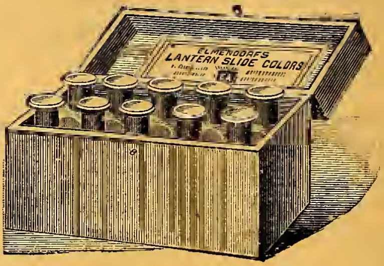
Made in professional sizes also

Ask your dealer to show you the Eagle tank

GEORGE MURPHY, Inc. : NEW YORK

Kindly mention THE PHOTO-MINIATURE

ELMENDORF LANTERN SLIDE COLORS



Prepared by Dr. Elmendorf, the acknowledged authority on lantern slides, whose superbly colored slides are famous all the world over.

Permanent: Easily Applied

These colors have been on the market for years and are considered *Perfection* for lantern slide coloring because of their perfect transparency and brilliancy.

Supplied in ten colors, the combinations of which will reproduce all the colors of nature and any desired effect.

Full instructions with each set.

Price, per set of 10 colors $1.50

Each set contains one bottle of each color,
Small bottles, any color, 20 cts. Large bottles, 30 cts.

Insist on Elmendorf Lantern Slide Colors and make sure of success.

Trade Agents

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ROSS LENSES

NEW PATENT
HOMOCENTRIC
SERIES C. f/6.3

Unequaled for Hand-Camera Work, Instantaneous Views and Groups. Giving brilliant Images, with Perfect Definition over a Wide Angle and Critical Definition. The single combinations may be used for subjects requiring long focus.

No.	Equiv. Focus	Plate Covered		Price
C1	5 inch	3¼ x 4¼	4 x 5	**$29.00**
2	5½ "	3½ x 4¾	5 x 6	**31.00**
3	6 "	4 x 5	4¾ x 6½	**32.00**
4	7 "	4¾ x 6½	5 x 7½	**40.00**
5	8½ "	5 x 7½	6½ x 8½	**51.00**
6	10 "	6½ x 8½	8 x 10	**69.00**
7	12 "	8 x 10	10 x 12	**91.00**

ROSS "SPECIAL" LENSES

For Kodaks, Hand Cameras and All Good Cameras

Supplied in cells in a neat case. Fit the Kodak Automatic Shutter and other shutters. Speed and focusing scale supplied.

ROSS SPECIAL Homocentric	5 in.	F 6.3	$25.00
ROSS SPECIAL Homocentric	6½ in.	F 6.3	$30.00
ROSS SPECIAL Homocentric	8½ in.	F 8.	$35.00
ROSS-GOERZ SPECIAL III	5 in.	F 6.8	$32.00
ROSS-GOERZ SPECIAL III	6 in.	F 6.8	$39.00
ROSS-GOERZ SPECIAL III	8¼ in.	F 6.8	$53.50

The Ross "Specials" will furnish you with a high-grade lens, with speed and definition, doubling the power of your kodak or other hand-cameras. Ross Lenses are absolutely free from spherical and zonal aberration and possess exquisite defining power. Enlargements from negatives made with Ross Lenses are perfect in detail and fineness of contrast

Send for the New Ross Lens List. Free on Request.

ROSS-ZEISS TESSAR LENSES
ROSS-GOERZ DOUBLE ANASTIGMATS

American Agents

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TRADE-MARK

AUTOTYPE SPIRIT SENSITIZER

for quickly sensitizing carbon tissues

A BOON TO THE AMATEUR AND PROFESSIONAL ALIKE

This sensitizer will be specially appreciated by those who use carbon tissues in small quantities or only occasionally. No special drying room or apparatus are needed. The tissue is simply sensitized with a brush and dries so quickly that it can be printed from within a few minutes.

Simplifies carbon printing immensely

PRICE 50 CENTS PER BOTTLE WITH BRUSH AND INSTRUCTIONS

SOME PRESS OPINIONS

The Photo-Miniature

It does away with the only tedious detail in carbon printing and is bound to make the process popular.

The British Journal of Photography

In our trials of the new sensitizer, the tissue was dried in an ordinary room with the blinds drawn down. The tissue was pinned on the back of a fire-screen placed on the table. It dried in about fifteen minutes.

The London Morning Post

Not only may one at any moment rapidly sensitize and print carbon tissue, but there is practically no need to touch the bichromate with one's fingers. Moreover, the occasional tendency for the film sensitized in the older way to stick to its temporary support is practically done away with

The Amateur Photographer

The Autotype Company have by the invention of their new sensitizing solution done a great deal to popularize the beautiful carbon process, and eliminate any existing chances of failure. Our readers will do well now to order the insensitive tissue, which will keep indefinitely, and they will find it extremely easy to sensitize a short time only before it is required for actual use. The price is 50 cents per bottle of eight ounces, including the Blanchard brush.

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SEND TODAY FOR PARTICULARS

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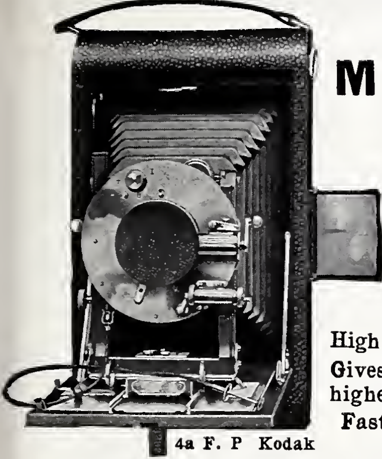


4a F. P Kodak

THE MEDIUM SIZE

MULTI-SPEED SHUTTER

the fastest and most efficient shutter

This size is for a 4a KODAK, and 5 x 7 and larger cameras

High Inst. Speeds from $\frac{1}{200}$ to $\frac{1}{2000}$ second. Gives three times as much illumination on highest speeds as the focal plane shutter. Fast instantaneous exposures without sunlight.

$\frac{1}{600}$ part of a second will do all speed work as done at present.
Low Inst. Speeds from several seconds to $\frac{1}{100}$ part of a second.
For all instantaneous exposures over 100 per cent increase of definition with full open lens.
Slow Instantaneous, bulb and time exposures absolutely noiseless.
Separate diaphragm. One spring. Correct speed indications for all speeds.
F6.8 lenses fast enough for fastest work.
The only shutter with which the highest speed exposures on films are possible.
All these claims are guaranteed to be true and also the broadest guarantee for the quality of the shutter.
To convince the purchaser, we will mount his lens to shutter and send shutter to his dealer for two weeks' trial. Shutter and lens will be shipped 4 days after receiving lens.

ONE OF MANY TESTIMONIALS RECEIVED.

Brooklyn, N. Y., Sept. 17, 1907.

MULTI-SPEED SHUTTER CO., NEW YORK, N. Y.

GENTLEMEN:—I question whether an amateur's testimonial will be of any value to you but I have been so thoroughly satisfied with the performance of my shutter that I feel called upon to endorse it in every way.

I was very skeptical at first over many of the points which you claimed for it but six months' hard use has proved all which you claim to be perfectly true. It has also demonstrated to my complete satisfaction that your shutter is built for hard work, as most of my summer's work has been along the dunes and over the dustiest of roads, and yet I believe that my shutter works better now than when it was new.

My friend, F. A. Walter, Esq., the professional, tells me that he has abandoned his focal-plane cameras entirely and uses your shutter and a long-focus lens in making all of his wonderful pictures of horses.

With best wishes for your prosperity, I am, very truly yours,

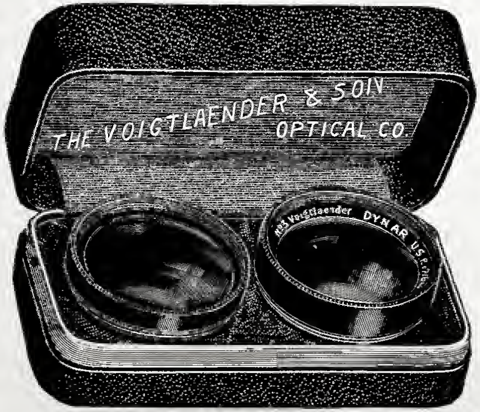
NATHAN T. BEERS, M. D., *Vice President, Dept. of Photography,*
Brooklyn Institute of Arts and Sciences.

The small size shutter for 4 x 5 and 3a KODAK will not be ready before the middle of winter

Ask your dealer for our booklet

MULTI-SPEED SHUTTER COMPANY
324 East 65th Street - - NEW YORK

VOIGTLAENDER LENSES
FOR
POCKET KODAKS



No New Shutter Required

FITS RIGHT INTO KODAK SHUTTERS

FOR 3a & 4 and F. P. K.

Dynar No. 3, Special -	$25.00
Collinear No. 3, Special	$30.00

Both 6½ inch focus

FOR 4a F. P. K.

Dynar No. 4 - - -	$30.00
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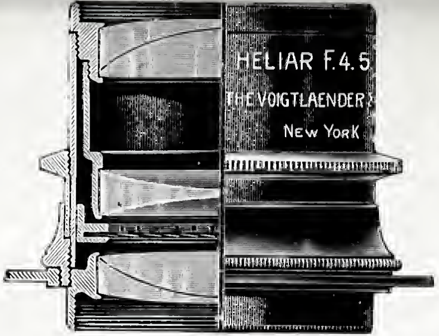
THE HELIAR

FOR FOCAL-PLANE SHUTTERS



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Lenses obtainable for trial or inspection
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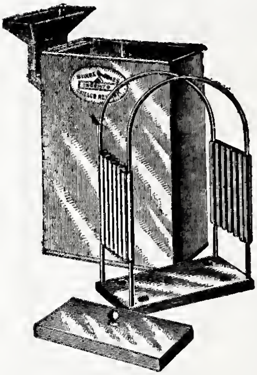
DAYLIGHT DEVELOPING, FIXING AND WASHING

ALL OPERATIONS EXCEPT INSERTING THE PLATES ARE DONE BY DAYLIGHT



Style "A"

Ingento Automatic Developing Tank

Better negatives with less labor. Simplicity of operation without the tedious and uncertain dark-room manipulation. No fog or scratch. Complete directions and formulæ with each tank.

It is no experiment. Indorsed by the highest authorities

PRICES

STYLE A—Made of Brass with Removable Rack, for Developing, Fixing and Washing.

NO	SIZE	PRICE
6	3¼ x 4¼, or L. S.	$2 00
6½	3¼ x 5½	2 00
7	4 x 5	2 00
7½	4¼ x 6½	3 00
8	5 x 7	3 00
9	6½ x 8½	3 50
10	8 x 10	5 00

STYLE B—Made of Zinc, for Developing and Washing only. Fixing cannot be done in this tank.

NO.	SIZE	PRICE
1	3¼ x 4¼	$1 00
2	4 x 5	1 00
2½	4¼ x 6½	1 50
3	5 x 7	1 50
4	6½ x 8½	1 75
5	8 x 10	2 00

Style "B"

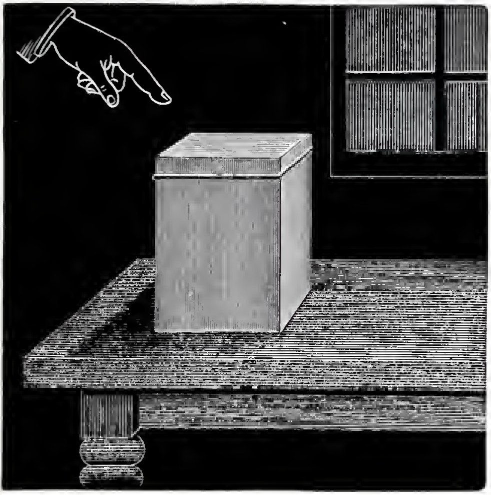
Ask Your Dealer to Show It

BURKE & JAMES

118 WEST JACKSON BLVD., CHICAGO

The Original Auto-Tank

In This
Mysterious
Box
18 Plates Are
Developing
At One Time
Without
Attention



No Other Tank Holds So Many Plates.

It Is the Only Tank with a Hinged Rack to Permit the Plates Being Examined without Entire Removal from the Developer.

Practical Experience Has Proven Its Efficiency.

Thousands Have Been Sold and Every Purchaser Is Delighted.

You Do Not Want to Worry over Your Exposures.

The Auto-Tank will Give Results

No. 1.—**"Auto Tank"** with rack to hold 13 3¼x4, 13 3¼x4¼, 13 3¼x5½, 8 4x5 or 8 5x7 plates complete with 4 oz. bottle of concentrated **"Auto Developer"**	$2.00
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No. 4.—**"Auto Tank"** with rack to hold 29 3¼x4, 29 3¼x4¼, 8 6½x8½ or 8 8x10 plates complete with 4 oz. bottle of concentrated **"Auto Developer"**	3.00

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For Winter Work
and Short Exposures

For Tank and
Time Development

That Brown Box with the Red Label

Contains the best and fastest plate for all classes of photographic work. Ask your dealer for them

QUICK AS A FLASH

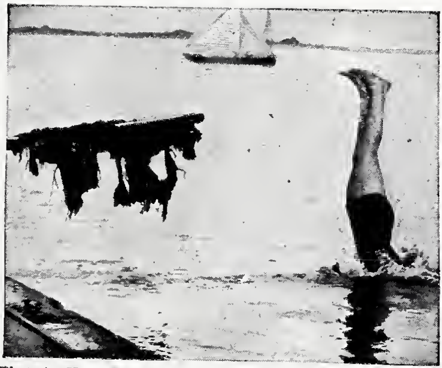

Photo by H. S. Adams, Boston.

COOKE LENSES make pictures like this. Nothing is too quick for them, nor is any test too severe for their wonderful definition. They are UNIVERSAL, and are used with the same success—be it for a Kodak snapshot, a piece of fine portraiture, or for a photograph of the stars at the Harvard Observatory. Write today for our catalogue, containing "Helps to Photographers."

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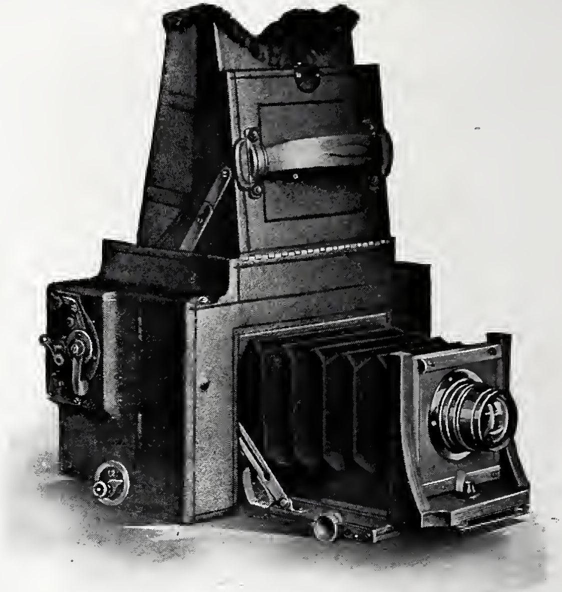
3A GRAFLEX



The Graflex idea combined with Film simplicity and convenience makes the

3A GRAFLEX

the ideal camera for outdoor photography.

The composition of the picture is seen on the ground-glass, right side up, full size of the negative, at the instant of exposure.

The 3A Graflex takes 3A (3 1-4 x 5 1-2) Kodak Film

3A Graflex with Bausch & Lomb Tessar Lens, $124

Catalogue at the dealers or

FOLMER & SCHWING CO.
ROCHESTER, N. Y.

RODINAL

IS THE BEST TANK DEVELOPER

SIMPLE : CLEANLY
ECONOMICAL : EFFICIENT
NON-POISONOUS

CUT THIS OUT

Rodinal . .	1 part
Water . .	40 parts
Time .	20 minutes

List Prices

3-oz. bottle . . .	$0.60
8-oz. bottle . . .	1.10
16-oz. bottle . .	2.00

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Sole United States Agents
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¶We have made a noteworthy addition to our famous Tessar Series by the production of the

Bausch & Lomb-Zeiss New Tessar f-4.5

The new Tessar has been designed for extra rapid work, the speed being twice as great as the f-6.3 Tessar, and it brings within easy and sure range the most exacting demands of work requiring great speed.

¶While the aperture has been increased, brilliance, definition and flatness of field have not been sacrificed.

¶The new Tessar has this speed of f-4.5 in all the numbers of the series up to and including the largest sizes.

¶We should like to send you our Catalog H which fully describes the new Tessar, as well as our complete series of lenses.

¶ "PRISM" IS A LITTLE MAGAZINE we publish monthly. Not a mere advertisement, but a beautifully made and printed little publication about that world of wonder and beauty seen by the lens. Send us your name and we will enter your subscription FREE.

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Premo Film Pack. 12 Ex. 4x5
IT'S GOOD ENOUGH FOR ME

Premo Film Pack

is used exclusively by the United States Government to photograph every enlisted man for identification purposes.

A striking tribute to the unique merits of this system.

It offers the ground glass focusing features of plates, combined with all the conveniences of films, and permits the removal of one or more films for development at any time.

If you have a plate camera, get a Premo Adapter and you can use daylight loading films at will.

Our Uncle Sam booklet will tell you all about it. This and catalogue of over twenty different cameras, mailed free on request.

"If it's good enough for Uncle Sam, it's good enough for you."

Rochester Optical Division

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57 East 9th Street - - New York

Eastman Kodak Company

ROCHESTER, N. Y., ***The Kodak City***

CLEVERLY LINKED

Number eighty-two of *The Photo-Miniature* contains an article on Modern Dark-Rooms, from which we excerpt the following:

"It may seem paradoxical to begin a book avowedly devoted to the dark-room with a dissertation on the possibility of dispensing altogether with this one time necessity in photography.

"Both films and plates may be changed, developed and fixed in daylight by the use of cleverly devised tanks, so compact and dainty in their construction, that my lady can carry one in her hand bag without perceptibly adding to its weight, or fear of soiling the most delicate lingerie; or the military photographer on the fighting-line can sling the tank on his belt with his water-bottle and develop his day's exposures at the most convenient mud-puddle enroute.

"And, be it noted, these concessions to the great god Convenience have been granted, not at the expense of, but with added efficiency, for they are based on careful research and the elimination of uncertain and haphazard methods.

"Tank Development is not new. The early apparatus, however, was somewhat crude and a dark-room of some kind was essential at the beginning and end of development, so that one may fairly say that the advantages of the method were not generally appreciated until the Kodak Company introduced its now well-known tank method for the development of roll films; cleverly linking the advantages of the 'time and temperature' method with the practical convenience of the light-proof tank."

ONLY ONE

In winter the photographer has more to contend with than during the summer solstice. The light is yellower and slower, tending to longer exposures and the consequential danger of halation.

Under such conditions, to properly record what the lens brings into focus, requires a sensitive medium of unusual qualities. It must be rapid, sensitive in a high degree to the predominating colors and non-halation—and not the least—it must be light and compact so as not to render the trips afield a drudgery instead of a pleasure. Quite a formidable array of demands is it not? Yet every one of these good qualities may be found in one product, and in one only—and that is Eastman N. C. Film.

These multi-qualifications that render Eastman N. C. supreme have not always been a part of that product. They are the result of years and years of experience in film-making and film-selling. Not only have the theoretical demands of factory chemists been met, but also the demands of the *purchasing public.* These years of experience form an asset of inestimable value and one that can be duplicated only by a similar number of years under equally favorable conditions.

Every roll of experience film has "Kodak" on the spool end.

PORTRAIT POSSIBILITIES

The great charm of Kodakery lies in its universal adaptation to every time, place and mood. If the out-of-doors calls you, what a multiplicity of things invite your selection. On the other hand, if old Boreas is on the rampage and forcibly reminds you that "there is no place like home," home will furnish an equal number of delightful subjects for the ever-ready and willing Kodak. There are the cosy corners, quiet library nooks, and even the kitchen will furnish material full of pictorial quality and interest. Whatever the environment, the human interest in the home is always the greatest, and however much we enjoy making pictures of the home, making pictures of those who make the home always furnishes the greatest pleasure.

And,—one of the greatest charms of home portraiture is its simplicity—simplicity not only of all necessary processes, but of the result, pictures of the loved ones as you know them in fami-

Eastman Kodak Company

ROCHESTER, N. Y., *The Kodak City*

liar dress, attitude and surroundings. Kodak Home Portraiture demands no extra apparatus, except a portrait attachment, just a simple extra lens which slips on in front of the regular lens and costs but fifty cents. Most anything neutral in tone will do for a background, and an adequate reflector may be formed with a towel suspended from a chair back.

FLORENCE. EDITH L. GARITT.

(Made with Kodak Portrait Attachment.)

Kodak Home Portraiture, a little booklet of suggestion containing some splendid examples of Kodak home pictures, may be had for the asking from any Kodak dealer, or direct from us by mail.

EASTMAN'S FLASH SHEETS

are the safest and most convenient preparation for flash-light work.

—Pin to a card, touch with a match—much or little illumination as you need—and—when and where you want it.

Eastman's Flash Sheets

No. 1, per pkg.	$0 25
Do. No. 2	40
Do. No. 3	60

All Dealers

Eastman Kodak Company
ROCHESTER, N. Y., *The Kodak City*

"It has been proved, by logic, by experiment and by rule of thumb, time after time, that tank development does all that hand and eye nursing can do, yet there are thousands who refuse to believe what is known as a fact, and who still stick to the old, red light, hot stuffy room and variable formula methods."

—*C. H. Claudy in "The Camera"*

The Experience is in the Tank

NOW READY—

Ozobrome

THE NEW PROCESS FOR MAKING CARBON PRINTS WITHOUT THE DIRECT ACTION OF LIGHT

Advantages of Ozobrome

The worker is independent of any light for printing, as no exposure of the tissue to light is required.

The sensitive material is bromide or Velox paper.

The print is produced by chemical action set up when the sensitized tissue and bromide or Velox print are placed in contact.

Carbon enlargements can be made from bromide or Velox enlargements, thus doing away with the trouble and expense of making enlarged negatives.

Ozobrome prints, with a choice of twelve colors, can be made either upon the original print or transferred to any suitable surface.

The image is not reversed, making double transfer a thing of the past.

A number of prints in Ozobrome can be made from one bromide or Velox print without the use of a negative, and the original print may still be retained unimpaired.

Any class of negative may be used for making the print or enlargement, as the numerous grades of bromide or Velox paper make it an easy matter to produce either soft or contrasty effects at will.

EASTMAN KODAK CO.

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on request

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Get more money for your work—Raise the QUALITY with Angelo Sepia and you can raise the PRICE.

Jos. Di Nunzio Division,

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Rochester, N. Y.

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THE SUCCESSFUL COMBINATION FOR

Flash Light and Short day Photography

ALWAYS FOUND IN

SEED

Gilt Edge 27.

"The Art of Negative Making" sent on request.

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No Juggling

Standard Orthonon

Double-coated Non-Halation and Orthochromatic. They successfully overcome inequalities of lighting and color value without recourse to juggling during development.

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The film with the speed of a Seed 27

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NC
NON-CURLING

The only film classed by experts with the fastest plates.

LOOK FOR *"KODAK"* ON THE SPOOL END

Right for Black and White
Rich when Sepia Toned

NEPERA

A SUPERIOR DEVELOPING Paper for use in PROFESSIONAL PORTRAITURE

Made with especial reference to the requirements of studio photography and is particularly adapted to the average portrait negative. Prints by any light. Uniform in surface and chemical quality.

THREE SURFACES: Velvet, Matt, Rough
Either Single or Double Weight

4 x 6 or CABINETS, (Single Weight) $2.00 PER GROSS

Sold in Professional Sizes Only, by all Stock Houses

Ready, September 15th

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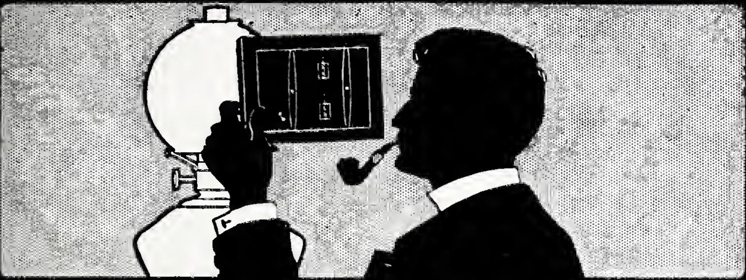
EASTMAN KODAK CO.
Rochester, N. Y.

Sample package, free to professional photographers, upon request



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Redeveloped with Velox Re-developer its rich Sepia tones afford just the proper warmth to landscapes, and to portraits a roundness and delicacy most alluring.

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